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Attorneys for Plaintiffs

15 UNITED STATES DISTRICT COURT
16
17 NORTHERN DISTRICT OF CALIFORNIA
18 SAN JOSE DIVISION

19 IN RE SEAGATE TECHNOLOGY LLC
LITIGATION

No. 3:16-cv-00523-JCS

20 DECLARATION OF STEVE W.
BERMAN IN SUPPORT OF
21 PLAINTIFFS' MOTION FOR CLASS
CERTIFICATION
22
23
24
25
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28

1 I, STEVE W. BERMAN, declare as follows:

2 1. I am the managing partner of the law firm Hagens Berman Sobol Shapiro LLP,
3 attorneys for plaintiffs in the above-titled action. I have personal knowledge of the matters stated
4 herein and, if called upon, I could and would competently testify thereto.

5 2. Plaintiffs have actively served the class thus far, including responding to multiple
6 discovery requests, producing documents, and traveling multiple days to attend their depositions.

7 3. Attached hereto are true and correct copies of the following exhibits:

8 Exhibit 1: Document Bates-numbered FED SEAG0027180-0027181, produced in the
9 above-captioned litigation by Defendant;

10 Exhibit 2: Document Bates-numbered FED SEAG0031453-0031473, produced in the
above-captioned litigation by Defendant;

11 Exhibit 3: Document Bates-numbered FED SEAG0012340-0012364, produced in the
12 above-captioned litigation and designated "CONFIDENTIAL" by Defendant
pursuant to the protective order in this action;

13 Exhibit 4: Document Bates-numbered FED SEAG0018291-0018292, produced in the
14 above-captioned litigation and designated "CONFIDENTIAL" by Defendant
pursuant to the protective order in this action;

15 Exhibit 5: Document Bates-numbered FED SEAG0020297-0020298, produced in the
16 above-captioned litigation and designated "CONFIDENTIAL" by Defendant
pursuant to the protective order in this action;

17 Exhibit 6: Document Bates-numbered FED SEAG0004700-0004701, produced in the
18 above-captioned litigation and designated "CONFIDENTIAL" by Defendant
pursuant to the protective order in this action;

19 Exhibit 7: Document Bates-numbered FED SEAG0000440-0000441, produced in the
20 above-captioned litigation by Defendant;

21 Exhibit 8: Document with the identification number of PLTFS 000106-000114,
produced in the above-captioned litigation by Plaintiffs;

22 Exhibit 9: Document Bates-numbered FED SEAG00002505-0002557, produced in the
23 above-captioned litigation and designated "CONFIDENTIAL" by Defendant
pursuant to the protective order in this action;

24 Exhibit 10: Excerpts from the Deposition of Jeffrey Fochtman, taken in the above-
25 captioned litigation on August 19, 2017 and designated "HIGHLY
CONFIDENTIAL" by Defendant pursuant to the protective order in this
26 action;

27 Exhibit 11: Document Bates-numbered FED SEAG0015567-0015568, produced in the
28 above-captioned litigation and designated "CONFIDENTIAL" by Defendant
pursuant to the protective order in this action;

- 1 Exhibit 12: Document Bates-numbered FED_SEAG0005081-0005100, produced in the
2 above-captioned litigation and designated "CONFIDENTIAL" by Defendant
3 pursuant to the protective order in this action and marked as Exhibit 3 to the
4 August 19, 2017 deposition of Jeffrey Fochtman;
- 5 Exhibit 13: Desktop HDD 2012 Data Sheet dated December 2012;
- 6 Exhibit 14: April 26, 2012, website screenshot, "Desktop Hard Drives," captured at
7 <https://web.archive.org/web/20120426215455/>;
- 8 Exhibit 15: Barracuda Data Sheet dated November 2011;
- 9 Exhibit 16: Storage Solutions Guide dated October 2012;
- 10 Exhibit 17: Desktop HDD Product Manual dated March 2016;
- 11 Exhibit 18: Document Bates-numbered FED_SEAG0004438-0004475, produced in the
12 above-captioned litigation and designated "CONFIDENTIAL" by Defendant
13 pursuant to the protective order in this action;
- 14 Exhibit 19: Document Bates-numbered FED_SEAG0003639-0003676, produced in the
15 above-captioned litigation and designated "CONFIDENTIAL" by Defendant
16 pursuant to the protective order in this action;
- 17 Exhibit 20: Documents Bates-numbered FED_SEAG0004783-0004810, produced in the
18 above-captioned litigation and designated "CONFIDENTIAL" by Defendant
19 pursuant to the protective order in this action;
- 20 Exhibit 21: Document Bates-numbered FED_SEAG0006442-0006445, produced in the
21 above-captioned litigation and designated "CONFIDENTIAL" by Defendant
22 pursuant to the protective order in this action;
- 23 Exhibit 22: Document Bates-numbered FED_SEAG0057214-0057216, produced in the
24 above-captioned litigation and designated "HIGHLY CONFIDENTIAL" by
25 Defendant pursuant to the protective order in this action;
- 26 Exhibit 23: Document Bates-numbered FED_SEAG0002673-0002680, produced in the
27 above-captioned litigation and designated "CONFIDENTIAL" by Defendant
28 pursuant to the protective order in this action;
- Exhibit 24: Document Bates-numbered FED_SEAG0024743-0024763, produced in the
above-captioned litigation and designated "HIGHLY CONFIDENTIAL" by
Defendant pursuant to the protective order in this action;
- Exhibit 25: Document Bates-numbered FED_SEAG0010102-0010111, produced in the
above-captioned litigation and designated "CONFIDENTIAL" by Defendant
pursuant to the protective order in this action;
- Exhibit 26: Document Bates-numbered FED_SEAG0054829-0054832, produced in the
above-captioned litigation and designated "CONFIDENTIAL" by Defendant
pursuant to the protective order in this action;
- Exhibit 27: Excerpts from the Deposition of Alan Weir Clark, taken in the above-
captioned litigation on October 20, 2017;

- 1 Exhibit 28: Defendant Seagate Technology LLC's Supplemental Responses to Plaintiff
- 2 Christopher Nelson's First Set of Interrogatories, dated August 18, 2017, and
- 3 designated "HIGHLY CONFIDENTIAL" by Defendant;
- 4 Exhibit 29: Excerpts from the Deposition of Dennis Crawford, taken in the above-
- 5 captioned litigation on June 15, 2017;
- 6 Exhibit 30: Excerpts from the Deposition of Dudley Lane Dortch, IV, taken in the
- 7 above-captioned litigation on July 12, 2017;
- 8 Exhibit 31: Excerpts from the Deposition of Joshua Enders, taken in the above-
- 9 captioned litigation on June 7, 2017;
- 10 Exhibit 32: Excerpts from the Deposition of David Schechner, taken in the above-
- 11 captioned litigation on June 6, 2017;
- 12 Exhibit 33: Excerpts from the Deposition of James Hagey, taken in the above-captioned
- 13 litigation on July 24, 2017;
- 14 Exhibit 34: Excerpts from the Deposition of Nikolas Manak, taken in the above-
- 15 captioned litigation on July 24, 2017;
- 16 Exhibit 35: Excerpts from the Deposition of Christopher Nelson, taken in the above-
- 17 captioned litigation on June 2, 2017;
- 18 Exhibit 36: Excerpt from documents Bates-numbered FED SEAG00035341-42,
- 19 produced in the above-captioned litigation and designated
- 20 "CONFIDENTIAL" by Defendant pursuant to the protective order in this
- 21 action;
- 22 Exhibit 37: Excerpts from the Seagate Technology 30(b)(6) Deposition of Bruce Marc
- 23 Schwartz, taken in the above-captioned litigation on October 19, 2017;
- 24 Exhibit 38: Document Bates-numbered FED SEAG0002103-0002105, produced in the
- 25 above-captioned litigation and designated "CONFIDENTIAL" by Defendant
- 26 pursuant to the protective order in this action;
- 27 Exhibit 39: Document Bates-numbered FED SEAG0009464, produced in the
- 28 above-captioned litigation and designated "CONFIDENTIAL" by Defendant
- 29 pursuant to the protective order in this action;
- 30 Exhibit 40: Document Bates-numbered FED SEAG0012108-0012148, produced in the
- 31 above-captioned litigation and designated "CONFIDENTIAL" by Defendant
- 32 pursuant to the protective order in this action;
- 33 Exhibit 41: Document Bates-numbered FED SEAG0015574-0015576, produced in the
- 34 above-captioned litigation and designated "CONFIDENTIAL" by Defendant
- 35 pursuant to the protective order in this action;
- 36 Exhibit 42: Document Bates-numbered FED SEAG0006016-0006018, produced in the
- 37 above-captioned litigation and designated "CONFIDENTIAL" by Defendant
- 38 pursuant to the protective order in this action;
- 39 Exhibit 43: Document Bates-numbered FED SEAG0004853-0004854, produced in the

above-captioned litigation and designated “CONFIDENTIAL” by Defendant pursuant to the protective order in this action;

Exhibit 44: Document Bates-numbered FED SEAG0010119-0010125, produced in the above-captioned litigation and designated “CONFIDENTIAL” by Defendant pursuant to the protective order in this action;

Exhibit 45: Document Bates-numbered FED SEAG0004309-0004347, produced in the above-captioned litigation and designated “CONFIDENTIAL” by Defendant pursuant to the protective order in this action;

Exhibit 46: Document Bates-numbered FED SEAG0015901-0015907, produced in the above-captioned litigation and designated “HIGHLY CONFIDENTIAL” by Defendant pursuant to the protective order in this action;

Exhibit 47: Document Bates-numbered FED SEAG0016455, produced in the above-captioned litigation and designated “CONFIDENTIAL” by Defendant pursuant to the protective order in this action;

Exhibit 48: Document Bates-numbered FED SEAG0018144-0018176, produced in the above-captioned litigation and designated “HIGHLY CONFIDENTIAL” by Defendant pursuant to the protective order in this action;

Exhibit 49: Document Bates-numbered FED SEAG0035574-0035581, produced in the above-captioned litigation and designated “CONFIDENTIAL” by Defendant pursuant to the protective order in this action;

Exhibit 50: Document Bates-numbered FED SEAG0000506, produced in the above-captioned litigation by Defendant;

Exhibit 51: Document Bates-numbered BB CTRL0000194, produced in the above-captioned litigation and marked “Seagate Confidential” by Defendant;

Exhibit 52: Declaration of Derek Noer; and

Exhibit 53: Firm Resume of Hagens Berman Sobol Shapiro LLP.

I declare under penalty of perjury under the laws of the United States that the foregoing is true and correct. Executed this 8th day of November, 2017 at Seattle, Washington.

s/ Steve W. Berman

STEVE W. BERMAN

EXHIBIT 3



Storage Solutions Guide

OCTOBER 2013 | AMER

ROOM TO GROW

Double the storage.
Half the space.



New 8-Bay Rackmount NAS

The first 1U rack that
fits 8" 3.5" drives

Make the perfect gift complete.



Complete your tablet with
1TB of storage to carry and stream 500+
movies or thousands of songs.
No internet required.



Wireless Plus
Mobile Device Storage



www.seagate.com

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External Storage

At-a-Glance Product Comparison

AT-A-GLANCE PRODUCT COMPARISON

	BACKUP PLUS					SLIM		EXPANSION		
Direct Attached/Portable										
	Backup Plus Portable	Backup Plus Portable for Mac	Backup Plus for Mac Portable Thunderbolt	Backup Plus Desktop	Backup Plus Desktop for Mac	Backup Plus for Mac Desktop Thunderbolt	Slim Portable	Slim Portable for Mac	Expansion Portable	Expansion Desktop
PERFECT FOR	Protecting and sharing digital memories			Keeping your digital life safe and sound		Keeping your digital life safe and sound	Thin storage that fits—and goes—anywhere		Protecting and sharing your digital life	
DESCRIPTION	Store and back up the content on your social networks with these flexible, portable drives. PC or Mac.			These desktop drives provide the simple, one-click way to protect and share files. PC or Mac.		These desktop drives provide the simple, one-click way to protect and share files. Mac.	This ultra-thin metal design is the world's sleekest portable external hard drive. PC or Mac.		Expansion drives allow you to instantly add more storage space to your computer and take large files with you.	
LEARN MORE	Page 5	Page 6	Page 6	Page 8	Page 7	Page 7	Page 9	Page 8	Page 10	Page 9

Wireless Mobile	Network Attached					
	 					
	Wireless Plus	Business Storage 8-Bay Rackmount NAS	Business Storage 4-Bay Rackmount NAS	Business Storage 8-Bay NAS	Business Storage 4-Bay NAS	Business Storage 2-Bay NAS
PERFECT FOR	Wireless storage for your tablet	Centralized storage and backup		Centralized storage, collaboration and backup		Wireless centralized home storage
DESCRIPTION	Take your media library on the go and stream it wirelessly to your iPad, Android tablet and smartphone. PC or Mac.	The first 1U rack that fits eight hot-swappable 3.5-inch drives	A complete, high-performance network storage for businesses with up to 100 employees	A complete network storage solution and private cloud for businesses of up to 50 employees.	A complete network storage solution and private cloud for businesses of up to 25 employees.	A complete network storage solution and private cloud for home of iOs.
LEARN MORE	Page 10	Page 11	Page 12	Page 12	Page 13	Page 13

External Storage Solutions

Seagate external storage solutions are sleek, dependable and ultra-portable products that let your customers automatically and continuously store digital family photos, protect critical business data, back up multiple computers on a small network, or share and store videos and music.

EXTERNAL STORAGE

Backup Plus

The Backup Plus portable drive is the simple way to protect and share your entire digital life.

Key Advantages

- † Easy, flexible backups
- † Automatically saves photos from social networks
- † Photos and videos can be shared to social networks with a click
- † Thunderbolt technology or FireWire 800 upgrade allows higher transfer speeds

Best-Fit Applications

- † Store or back up photos, movies, music and documents
- † Download and save content that's posted on your social networks
- † Share your digital memories to your social networks with a click

CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
1TB	STBU1000100	USB 3.0	● Black	PC, Mac
1TB	STBU1000101	USB 3.0	● Silver	PC, Mac
1TB	STBU1000102	USB 3.0	● Blue	PC, Mac
1TB	STBU1000103	USB 3.0	● Red	PC, Mac
750GB	STBU750100	USB 3.0	● Black	PC, Mac
PRODUCT DIMENSIONS	4.86-in L x 3.19-in W x 0.57-in D (123.4mm x 81.1mm x 14.5mm)			
PACKAGE DIMENSIONS	5.2-in L x 1.81-in W x 6.54-in D (132mm x 46mm x 166mm)			



† One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes (not referring to drive capacity). 2TB is equal to two trillion bytes.

STORAGE SOLUTIONS GUIDE 5

FED_SEAG0012343

CONFIDENTIAL

Backup Plus for Mac

The Backup Plus portable drive for Mac is the simple way to protect and share your entire digital life.

Key Advantages

- Mac OS and Time-Machine ready out of the box
- Automatically saves photos from social networks
- Share photos and video to social networks with a click
- Easily increase transfer speeds by upgrading to Thunderbolt technology

Best-Fit Applications

- Store or back up photos, movies, music, and documents
- Download and save content that's posted on your social networks
- Share your digital memories to your social networks with a click



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
4TB	STBW1000000	USB 3.0	Black or White	Mac, PC
PRODUCT DIMENSIONS	4.86-in L x 3.19-in W x 0.57-in D (123.4mm x 81.5mm x 14.5mm)			
DEVICE DIMENSIONS	5.2-in L x 1.61-in W x 0.54-in D (132mm x 40mm x 13.6mm)			

Backup Plus Desktop for Mac

The Backup Plus desktop drive for Mac is the simple, one-click way to protect and share your entire digital life.

Key Advantages

- Mac OS and Time Machine ready right out of the box
- Automatically saves photos from social networks
- Share photos and video to social networks with a click
- Up to 3TB capacity for a lifetime of memories

Best-Fit Applications

- Back up all your important files
- Download and save content that's posted on your social networks
- Share your digital memories to your social networks with a click



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
4TB	STDB4000001	USB 3.0	Black or Silver	Mac, PC
3TB	STDB3000000	USB 3.0	Black or Silver	Mac, PC
2TB	STDB2000000	USB 3.0	Black or Silver	Mac, PC
PRODUCT DIMENSIONS	6.22-in L x 4.88-in W x 1.73-in D (158mm x 124mm x 44mm)			
DEVICE DIMENSIONS	7.87-in L x 9.08-in W x 3.54-in D (200mm x 230mm x 90mm)			

Backup Plus for Mac Portable Thunderbolt™

The Thunderbolt Backup Plus for Mac portable drive is everything you need to transfer, store and back up files using Thunderbolt technology.

Key Advantages

- Includes Thunderbolt cable, adapter and drive
- Compatible with Time Machine software
- Compatible with Thunderbolt devices
- No external power supply required

Best-Fit Applications

- Combine high-speed data transfer and high-definition display in a single interface
- Unleash your creativity using high-bandwidth media-capturing devices while processing in real time
- Handle vast amounts of data more precisely than with any other connection
- Back up and restore data at 10Gbps



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
4TB	STBW1000401	Thunderbolt	Black	Mac, PC
PRODUCT DIMENSIONS	5.12-in L x 3.19-in W x 1.09-in D (130mm x 81mm x 27.8mm)			
DEVICE DIMENSIONS	6.69-in L x 5.24-in W x 1.81-in D (170mm x 133mm x 46mm)			

Backup Plus for Mac Desktop Thunderbolt

The Thunderbolt Backup Plus for Mac desktop drive is everything you need to transfer, store and back up files using Thunderbolt technology.

Key Advantages

- Includes Thunderbolt cable, adapter and drive
- Dual ports enable daisy-chaining up to six devices
- Compatible with Thunderbolt displays and other devices
- Compatible with Time Machine software

Best-Fit Applications

- Combine high-speed data transfer and high-definition display in a single interface
- Unleash your creativity using high-bandwidth media-capturing devices while processing in real time
- Handle vast amounts of data more precisely than with any other connection
- Back up and restore data at 10Gbps



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
4TB	STDB3000400	Thunderbolt	Black	Mac, PC
PRODUCT DIMENSIONS	6.61-in L x 4.76-in W x 2.42-in D (168mm x 120.9mm x 61.4mm)			
DEVICE DIMENSIONS	8.64-in L x 9.13-in W x 3.5-in D (219.5mm x 232mm x 89mm)			

Backup Plus Desktop

The Backup Plus desktop drive is the simple, one-click way to protect and share your entire digital life.

Key Advantages

- Easy, flexible, built-in backup options
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click.
- Up to 4TB capacity for a lifetime of memories
- Increase transfer speeds by upgrading to Thunderbolt technology or FireWire 800.

Best-Fit Applications

- Back up all your important files.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
4TB	STCA4000100	USB 3.0	Black	PC, Mac
3TB	STCA3000101	USB 3.0	Black	PC, Mac
2TB	STCA2000100	USB 3.0	Black	PC, Mac
1TB	STCA1000100	USB 3.0	Black	PC, Mac
RECLUT (DRIVE/DRIVE)	6.22-in L x 4.68-in W x 1.73-in D (158mm x 124mm x 44mm)			
RECLUT (DRIVE/DRIVE)	7.87-in L x 9.06-in W x 3.54-in D (200mm x 230mm x 90mm)			

Slim

The Seagate Slim portable drive is thin, light and the easiest way yet to back up the things that are important to you.

Key Advantages

- Just slightly thicker than an iPhone
- Protects your stuff with easy, flexible backups
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click.

Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
500GB	STC5000102	USB 3.0	Black	PC, Mac
500GB	STC5000104	USB 3.0	Silver	PC, Mac
RECLUT (DRIVE/DRIVE)	4.47-in L x 2.99-in W x 0.38-in D (113.5mm x 76mm x 9.6mm)			
RECLUT (DRIVE/DRIVE)	5.59-in L x 1.22-in W x 4.06-in D (142mm x 31mm x 103mm)			

Slim for Mac

The Seagate Slim portable drive for Mac combines a thin, light form factor in a Time Machine-ready drive.

Key Advantages

- Just slightly thicker than an iPhone
- Mac OS and Time Machine ready out of the box
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click.

Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
500GB	STC5000102	USB 3.0	Silver	Mac, PC
RECLUT (DRIVE/DRIVE)	4.47-in L x 2.99-in W x 0.38-in D (113.5mm x 76mm x 9.6mm)			
RECLUT (DRIVE/DRIVE)	5.59-in L x 1.22-in W x 4.06-in D (142mm x 31mm x 103mm)			

Expansion

The Expansion desktop drive provides extra storage for your ever-growing collection of files.

Key Advantages

- Simple and straightforward setup
- No software to install and nothing to configure
- Saving files is easy—simply drag and drop.
- USB 3.0 interface allows fast transfer speeds.

Best-Fit Applications

- Instantly add more storage space to your computer.
- Improve performance on your computer's internal drive by freeing up space on your internal drive.



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
4TB	STB44000100	USB 3.0	Black	PC
3TB	STB33000100	USB 3.0	Black	PC
2TB	STB22000100	USB 3.0	Black	PC
1TB	STB11000100	USB 3.0	Black	PC
RECLUT (DRIVE/DRIVE)	7.07-in L x 4.65-in W x 1.48-in D (179.5mm x 118mm x 37.5mm)			
RECLUT (DRIVE/DRIVE)	9.09-in L x 7.97-in W x 2.93-in D (231mm x 202mm x 72mm)			

Expansion

The Expansion portable drive is compact and perfect for taking large files with you on-the-go.

Key Advantages

- Simple and straightforward setup
- Powered from the USB cable
- Saving files is easy—simply drag and drop
- USB 3.0 interface allows fast transfer speeds.

Best-Fit Applications

- Instantly add more storage space to your computer.
- Take large files with you when you travel.



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
1TB	STBX1000101	USB 3.0	Black	PC, Mac
750GB	STBX0750100	USB 3.0	Black	PC, Mac
500GB	STBX0500100	USB 3.0	Black	PC, Mac
PRODUCT DIMENSIONS (inches)	5.04-in L x 3.51-in W x 0.87-in D (128.1mm x 89.1mm x 22mm)			
PRODUCT DIMENSIONS (mm)	4.81-in L x 3.19-in W x 0.61-in D (122.3mm x 81.1mm x 15.5mm)			
PRODUCT DIMENSIONS (mm)	5.28-in L x 6.69-in W x 1.89-in D (134mm x 170mm x 48mm)			

Central


The Central shared network storage system allows you to create secure in-home cloud storage for multiple computers in the home.

Key Advantages

- Automatically back up multiple PC and Mac computers
- Wirelessly stream your centralized media library to gaming consoles, media players and smart TVs
- Access content on-the-go with a Web browser or the free app for tablets and smartphones

Best-Fit Applications

- Consolidate content on one easily accessible device
- Back up multiple PC and Mac computers
- Enjoy a centralized media library on smart TVs, game consoles and media players
- Access your content on-the-go with laptops and mobile devices
- Archive your Facebook photos and videos



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
4TB	STCG4000100	SATA6Gb/s	Black	PC, Mac
3TB	STCG3000100	SATA6Gb/s	Black	PC, Mac
2TB	STCG2000100	SATA6Gb/s	Black	PC, Mac
PRODUCT DIMENSIONS (inches)	5.7-in L x 8.5-in W x 1.7-in D (145mm x 216mm x 43mm)			
PRODUCT DIMENSIONS (mm)	3.15-in L x 10.3-in W x 0.25-in D (80mm x 263mm x 23mm)			

Wireless Plus


With Wireless Plus mobile device storage, you can take your media library with you. Stream it to your iPad or Android tablet.

Key Advantages

- Take your media library with you on the go
- Share media with up to eight Wi-Fi enabled devices at the same time
- Use anywhere, without an Internet connection
- Up to 10 hours battery life*

Best-Fit Applications

- Store and carry movies and other media on the go
- Share media with others
- Works with iPad or Android tablets and smartphones



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
1TB	STCK1000100	USB 3.0	Gray	PC, Mac
PRODUCT DIMENSIONS (inches)	5.00-in L x 3.50-in W x 0.76-in D (127mm x 89mm x 19.9mm)			
PRODUCT DIMENSIONS (mm)	2.00-in L x 6.03-in W x 7.16-in D (51mm x 153mm x 182mm)			

Business Storage 8-Bay Rackmount NAS


A complete network storage solution with innovative 8-bay design in a 1U form factor that is perfect for growing businesses

Key Advantages

- A 2.3GHz dual-core Intel processor delivers file transfer performance of up to 200MB/s
- Wuala™ cloud service and apps for secure collaboration and anywhere access
- Centralized backup for PCs, plus Time Machine support for Mac computers
- Support for iSCSI enables maximum performance and compatibility for virtualized environments

Best-Fit Applications

- Store business-critical files centrally and securely
- Back up your organization's PC and Mac computers
- Access and manage files remotely using Internet-connected computers and devices
- Back up files to the cloud



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
32TB	STDP32000100	Gigabit Ethernet	Black	PC, Mac
24TB	STDP24000100	Gigabit Ethernet	Black	PC, Mac
16TB	STDP16000100	Gigabit Ethernet	Black	PC, Mac
12TB	STDP12000100	Gigabit Ethernet	Black	PC, Mac
8TB	STDP8000100	Gigabit Ethernet	Black	PC, Mac
PRODUCT DIMENSIONS (inches)	36.394-in L x 1.713-in W x 18.78-in D (772mm x 43.5mm x 477mm)			
PRODUCT DIMENSIONS (mm)	36.354-in L x 23.465-in W x 8.661-in D (926mm x 596mm x 220mm)			

Business Storage 4-Bay Rackmount NAS

Centralize your storage and backups with a complete network storage solution that saves valuable floor space for small businesses.



Key Advantages

- Centralized storage and backup for PCs and Macs, plus secure Wuala cloud off-site backup service
- A dual-core Intel Atom processor and new, performance-optimized Seagate NAS OS deliver file transfer speeds up to 200MB/s
- Anywhere access to your files
- Hot-swappable drives and dual Gigabit Ethernet ports help increase up-time

Best-Fit Applications

- Store business-critical files centrally and securely
- Back up your organization's PC and Mac computers
- Access and manage files remotely using Internet-connected computers and devices
- Back up files to the cloud

CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
16TB	STBN6000100	Gigabit Ethernet	Black	PC, Mac
12TB	STBN6000100	Gigabit Ethernet	Black	PC, Mac
8TB	STBN6000100	Gigabit Ethernet	Black	PC, Mac
4TB	STBN6000100	Gigabit Ethernet	Black	PC, Mac
—	STBN600	Gigabit Ethernet	Black	PC, Mac
HEIGHT (mm)	16.925-in L x 15-in W x 1.713-in D (430mm x 381mm x 42.5mm)			
WEIGHT (lb/kg)	22.44-in L x 19.567-in W x 6.496-in D (570mm x 497mm x 165mm)			

Business Storage 2-Bay NAS

Create a private cloud to help protect your business-critical data and centralize files in a single location you can access from anywhere.



Key Advantages

- Easy 10-minute setup
- Upload and download files with free apps for iPhone, iPad and Android devices
- Full-system, automatic backup for PCs, plus Time Machine support for Mac computers
- Customize performance and data redundancy with RAID 0 and 1 configuration options

Best-Fit Applications

- Make automatic, continuous backups of multiple PC and Mac computers
- Store files in a secure, central location
- Access and manage files remotely using Internet-connected computers, tablets and smartphones
- Create cost-effective, private cloud storage

CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
8TB	STBN6000100	Gigabit Ethernet	Black	PC, Mac
4TB	STBN6000100	Gigabit Ethernet	Black	PC, Mac
2TB	STBN6000100	Gigabit Ethernet	Black	PC, Mac
—	STBN600	Gigabit Ethernet	Black	PC, Mac
HEIGHT (mm)	4.1-in W x 8.0-in H x 8.9-in D (104.50mm x 204.00mm x 227.00mm)			
WEIGHT (lb/kg)	6.2-in W x 10.9-in H x 12.5-in D (157.00mm x 277.00mm x 317.00mm)			

Business Storage 4-Bay NAS

A complete, small-business-specific network storage solution designed to provide optimum uptime and data integrity for up to 50 workstations.



Key Advantages

- Easy 10-minute setup
- Upload and download files with free apps for iPhone, iPad and Android devices
- Full-system, automatic backup for PCs, plus Time Machine support for Mac computers
- Customize performance and data redundancy with RAID 0, 1, 5 and 10 configuration options

Best-Fit Applications

- Make automatic, continuous backups
- Store files in a secure, central location
- Access and manage files remotely using Internet-connected devices
- Create cost-effective, private cloud storage
- Encrypt individual files to entire volumes of data

CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
16TB	STBN6000100	Gigabit Ethernet	Black	PC, Mac
12TB	STBN6000100	Gigabit Ethernet	Black	PC, Mac
8TB	STBN6000100	Gigabit Ethernet	Black	PC, Mac
4TB	STBN6000100	Gigabit Ethernet	Black	PC, Mac
—	STBN600	Gigabit Ethernet	Black	PC, Mac
HEIGHT (mm)	6.3-in W x 8.2-in H x 10.2-in D (161.00mm x 206.00mm x 259.50mm)			
WEIGHT (lb/kg)	8.4-in W x 14.5-in H x 9.4-in D (240.00mm x 370.00mm x 240.00mm)			

Business Storage 1-Bay NAS

Create a private cloud with Seagate Business Storage 1-Bay NAS. It helps protect your all-important data and centralizes your files in a single location you can access from anywhere.



Key Advantages

- Easy 10-minute setup
- Upload and download files with free apps for iPhone, iPad and Android devices
- Full-system, automatic backup for PCs, plus Time Machine support for Mac computers
- Stream your media library to networked computers, Internet TVs, game consoles and more

Best-Fit Applications









- Make automatic, continuous backups of multiple PC and Mac computers
- Store files in a secure, central location
- Access and manage files remotely using Internet-connected computers, tablets and smartphones
- Create cost-effective, private cloud storage













CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
4TB	STBN6000100	Gigabit Ethernet	Black	PC, Mac
2TB	STBN6000100	Gigabit Ethernet	Black	PC, Mac
1TB	STBN6000100	Gigabit Ethernet	Black	PC, Mac
HEIGHT (mm)	2.4-in W x 6.9-in H x 8.8-in D (61mm x 176mm x 146mm)			
WEIGHT (lb/kg)	3.7-in W x 9.3-in H x 9.0-in D (93mm x 236mm x 229mm)			

AT-A-GLANCE PRODUCT COMPARISON

Internal Storage

At-a-Glance Product Comparison

	ENTERPRISE				DESKTOP		SPECIALTY	
3.5-inch								
	Chestah® 15K	Enterprise Capacity 3.5 HDD	Toshiba® T10	Desktop SSD HD	Desktop HDD	NAS HDD	Surveillance HDD	Video 3.5 HDD
USE THIS DRIVE FOR	High-capacity, compute-intensive requirements demanding high performance and availability	Bulk-data applications requiring reliable, highest-capacity storage efficiency and enterprise-class reliability	Cost-effective, low-power bulk storage solutions for unstructured data	Desktop solutions requiring SSD-like performance and massive capacities at an affordable price	Desktop compute where choice in capacity and cache options to provide design flexibility is important	Small NAS systems needing performance with high capacities, 3-year limited warranty	Surveillance systems that require high performance-low-power and centralized storage-in-every surveillance application, 3-year limited warranty	DVR systems where reliable, low-power, purpose-built storage is required for video streaming applications, 3-year limited warranty
ENCRYPTION MODELS AVAILABLE	X	X						
LEARN MORE	Page 25	Page 26	Page 28	Page 32	Page 32	Page 42	Page 42	Page 43

	SSD			ENTERPRISE SSD		ENTERPRISE		MOBILE			SPECIALTY	
2.5-inch												
	1000 SSD	600 Pro SSD	600 SSD	Enterprise Turbo SSD HD	Enterprise Performance 15K HDD	Desktop Performance 10K HDD	Consistent	Laptop SSD HD and Laptop Thin SSD HD	Minimius Thin	Laptop Ultrathin HDD	Ultra Mobile HDD	Video 2.5 HDD
USE THIS DRIVE FOR	Enterprise storage environments requiring high-capacity SSD with data integrity and drive endurance	Data center and cloud applications that require fast performance and low power	On-the-go users who need the fastest performance and improved ruggedness	Improved storage performance tier between SSDs and high-capacity HDDs	Compute-intensive data requirements demanding the highest HDD performance density and availability	Mainstream data requiring high capacity, performance density and reliability	Online reference data demands requiring cost-effective, low-power, enterprise-class drives	The ultimate mobile computing experience, with SSD-like performance for all applications and OS environments	Slim computing devices, such as laptops and notebooks	Slim laptops and devices that need light, affordable, high-capacity storage	Robust storage for high-capacity tablets and mobile applications	Video streaming where 24x7 operation, small form factor and low power consumption are needed, 3-year limited warranty
ENCRYPTION MODELS AVAILABLE			X	X	X	X	X		X	X		
LEARN MORE	Page 18	Page 18	Page 19	Page 22	Page 22	Page 24	Page 27	Page 36	Page 36	Page 37	Page 37	Page 43

Solid State Drive Solutions

Seagate is committed to the flash-based storage market, as is evident by its line of enterprise and client SSDs, engineered to deliver ultra-fast speed and high data integrity. Seagate is focused on the continuing technology leadership that allows it to be a premier supplier of both solid state drives and hard drives.



SPEED
Seagate SSDs
offer ultra-fast
performance

SSD STORAGE



1200 SSD



600 Pro SSD



600 SSD

Legacy Name			
Description	Ultra-fast, consistent performance for demanding enterprise storage and server applications	Fast performance and low power for performance-hungry data center and cloud applications	Speed up your laptop with SSD performance and ruggedness
Form Factor/z-Height	2.5-inch/7mm	2.5-inch/7mm	2.5-inch/5mm, 7mm
Reliability	0.44% AFR	0.58% AFR	0.58% AFR
Capacity ¹	200GB to 800GB	100GB to 480GB	120GB to 480GB
Endurance (total terabytes written over warranty period)	3650TBW to 14,600TBW	24TBW to 1080TBW	36.5TBW to 73TBW
NAND Flash Type	MLC	MLC	MLC
Power (idle)	2.73W to 3.0W	1.09W to 1.25W	1.1W
Interface	12Gb/s SAS	SATA 6Gb/s	SATA 6Gb/s
Limited Warranty ²	5 years	5 years	3 years
Product	1200 SSD	600 Pro SSD	600 SSD
Self-Encrypting Drive (SED) Option ³	X		
FIPS 140-2 SED Option ³	X		
Power Loss Data Protection	X	X	

¹ One gigabyte = 1GB, equals one billion bytes; one terabyte = 1TB, equals one trillion bytes; one petabyte = 1PB, equals one quadrillion bytes.
² Self-Encrypting Drive models may require TCG Opal and may not be available in all regions.
³ Some FIPS 140-2 SEDs are not available in all regions. See <http://www.seagate.com/enterprise/SSD/Products/SSD-1200> for more information.

1200 SSD


The Seagate 1200 SSD delivers best-in-class performance and a rich enterprise feature set for demanding data center applications.

Key Advantages

- Helps remove storage bottlenecks and close the gap between processor and data access performance
- Delivers the speed and performance consistency needed for demanding enterprise applications
- Designed to reduce data access wait times under the most complex, write-intensive workloads
- Ensures data availability for critical production systems by using redundant, failover I/O communication paths

Best-Fit Applications

- Demanding enterprise applications with complex, write-intensive and mixed workloads
- IOPS-hungry enterprise applications, such as high-performance computing, online transaction processing and heavy data analytics
- External enterprise storage solutions (SAN, NAS, DAS)



CAPACITY	MODEL	INTERFACE	NAND FLASH TYPE
800GB	ST800PM0053 ¹	SATA 12Gb/s	MLC
960GB	ST960PM0063 ²	SATA 12Gb/s	MLC
400GB	ST400PM0073 ³	SATA 12Gb/s	MLC
256GB	ST256PM0073 ³	SATA 12Gb/s	MLC

600 SSD

The ultimate performance upgrade for existing laptops, the Seagate 600 SSD is a fast, rugged, 2.5-inch, SATA 6Gb/s solid state drive.

Key Advantages

- Nearly 4" faster boot times and over 2" faster application load times than typical laptop HDDs
- Significantly reduces the amount of time end users must wait before using their devices
- Allows end users to access data faster and to take advantage of superior laptop responsiveness
- The ultimate upgrade drive for road warriors, power users, executives and gamers—work and play faster

Best-Fit Applications

- Performance upgrade for existing laptops with 2.5-inch hard drives
- Improved ruggedness upgrade for existing laptops that may be dropped while operating
- Data center caching



CAPACITY	7MM Z-HEIGHT MODEL	INTERFACE	NAND FLASH TYPE
480GB	ST480HM000	SATA 6Gb/s	MLC
240GB	ST240HM000	SATA 6Gb/s	MLC
120GB	ST120HM000	SATA 6Gb/s	MLC

CAPACITY	9MM Z-HEIGHT MODEL	INTERFACE	NAND FLASH TYPE
480GB	ST480MM001	SATA 6Gb/s	MLC
240GB	ST240MM001	SATA 6Gb/s	MLC
120GB	ST120MM001	SATA 6Gb/s	MLC

600 Pro SSD


A class above client SSDs, Seagate 600 Pro SSDs deliver a best-in-class combination of fast, consistent performance and low power.

Key Advantages

- Delivers the highest IOPS/watt to improve system performance and reduce power and cooling costs for data center and cloud applications
- Fast, consistent performance and low latency over the warranty period of the drive
- Helps reduce performance gaps between storage I/O and CPU operations

Best-Fit Applications

- Data center applications (fast data indexing, edge caching)
- Data streaming
- Content delivery networks
- Gaming and software delivery
- Virtualization and other cloud applications



CAPACITY	MODEL	INTERFACE	NAND FLASH TYPE
480GB	ST480PR0021	SATA 6Gb/s	MLC
400GB	ST400PR0021	SATA 6Gb/s	MLC
360GB	ST360PR0021	SATA 6Gb/s	MLC
200GB	ST200PR0021	SATA 6Gb/s	MLC
120GB	ST120PR0021	SATA 6Gb/s	MLC
100GB	ST100PR0021	SATA 6Gb/s	MLC



¹ Operating in 3.3V operation (3.3V only) and low standby (T3) mode and ultra-low power sleep mode (S3 mode).
² Full Recovery Drive (FDR) and 5-year MTBF, 10-12 terabyte drive life (TBW) and 100,000 write cycles.
³ 5-year MTBF and 100,000 write cycles support.

Enterprise Storage Solutions

With more than 30 years of experience and the broadest storage product portfolio available, Seagate consistently designs, builds and supports industry-leading enterprise hard drives, solid state drives and hybrid drives. Seagate has the global presence, processes and resources to support businesses of all sizes with the highest-quality enterprise storage products.

ENTERPRISE STORAGE



ENTERPRISE TURBO SSHD ENTERPRISE PERFORMANCE HDD CHEETAH FF ENTERPRISE CAPACITY HDD TERASCALE HDD CONSTELLATION CS

Product Comparison

Legacy Name	Savio®			Constellation	
Application	Highest SFF Performance	SFF Performance and Mainstream	LFF Performance	High Capacity and Low Power	Affordable High Capacity With Low Power
Description	World's fastest hard drive	Highest-performing, highly reliable 15K- and 10K-RPM enterprise hard drives in a 2.5-inch form factor	High-performance, legacy 15K-RPM enterprise hard drive in a 3.5-inch form factor	High-capacity, low-power, reliable 7200-RPM enterprise hard drive in both 2.5- and 3.5-inch form factors	High-capacity, eco-friendly, cost-effective storage for Web-scale data centers
Form Factor	2.5-inch	2.5-inch	3.5-inch	2.5-inch and 3.5-inch	3.5-inch
Reliability	0.44% AFR	0.44% AFR	0.55% AFR	0.62% and 1.09% AFR	800,000 MTBF
Capacity ¹	300GB to 900GB	300GB to 1200GB	300GB to 600GB	260GB to 4TB	1TB to 4TB
Power (idle)	4.83W to 5.3W	4.4W to 5.3W	8.74W to 11.68W	2.52W to 4.24W	up to 4.58W
Format	5x6, 4K	512N, 5x6, 4K	512N	512B, 5x6	512E
Interface	6Gb/s SAS	6Gb/s SAS, 4Gb/s FC	6Gb/s SAS, 4Gb/s FC	6Gb/s SAS, SATA 6Gb/s	SATA 6Gb/s
Limited Warranty ²	5 years	5 years	5 years	5 years	3 years

Feature Comparison

Product	Enterprise Turbo SSHD	Enterprise Performance 10K HDD	Enterprise Performance 15K HDD	Cheetah 15K	Enterprise Capacity 3.5 HDD	Enterprise Capacity 2.5 HDD	TeraScale HDD Constellation CS
Vibration Tolerance for Multi-Drive Stabilization	X	X	X	X	X	X	X
PowerChoice™ Optimized Idle Power Settings	X	X	X		X	X	X
Self-Encrypting Drive (SED) ³	X	X	X	X	X	X	
FIPS 140-2 SED Option ^{4,5}	X	X	X	X	X	X	
Instant Secure Erase	X	X	X		X	X	X
Solid State Hybrid	X						
Energy-Saving Features	X	X	X		X	X	X
RoHS Compliance	X	X	X	X	X	X	X

¹ One gigabyte (GB) equals one billion bytes and one terabyte (TB) equals one trillion bytes (not counting overhead).
² Self-Encrypting Drive model requires a T21 controller that is certified to support it.
³ SED is FIPS 140-2 Suite 2 certified and fully compliant with NIST SP 800-57 Part 1 Rev. 1.
⁴ Instant Secure Erase requires a T21 controller that is certified to support it.
⁵ Instant Secure Erase requires a T21 controller that is certified to support it.

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Enterprise Turbo SSHD

The Enterprise Turbo SSHD accelerates access to your most critical data with the world's fastest hard drive.



Key Advantages

- Hard drive capacities with flash-based performance
- Best economic combination of performance, endurance and capacity—best \$/IOPS enterprise HDD
- Meets critical demands for performance, scalability, flexibility and high density in a 2.5-inch form factor
- Automatically caches hot data to flash and absorbs write intensity by only promoting hot data
- Nonvolatile cache to enable faster write response time and help ensure data integrity during power loss

Best-Fit Applications

- Big data analytics
- Databases (ERP and OLTP)
- Virtual desktop infrastructure (VDI)
- Web development and Web page delivery

CAPACITY	500-BAY MODEL	INTERFACE	CACHE
600GB	ST600MM0004	6Gb/s SAS	128MB
800GB	ST800MM0014 ¹	6Gb/s SAS	128MB
1000GB	ST1000MM0024 ²	6Gb/s SAS	128MB
450GB	ST450MM0004	6Gb/s SAS	128MB
450GB	ST450MM0014 ¹	6Gb/s SAS	128MB
300GB	ST300MM0004	6Gb/s SAS	128MB
300GB	ST300MM0014 ¹	6Gb/s SAS	128MB

CAPACITY	4-K-NATIVE MODEL	INTERFACE	CACHE
600GB	ST600MM0034	6Gb/s SAS	128MB
800GB	ST800MM0044 ¹	6Gb/s SAS	128MB
800GB	ST800MM0054 ²	6Gb/s SAS	128MB
450GB	ST450MM0034	6Gb/s SAS	128MB
450GB	ST450MM0044 ¹	6Gb/s SAS	128MB
300GB	ST300MM0034	6Gb/s SAS	128MB
300GB	ST300MM0044 ¹	6Gb/s SAS	128MB

Enterprise Performance 15K HDD

Seagate Enterprise Performance 15K HDDs leverage a 2.5-inch form factor to deliver pronounced performance advantages and power savings over legacy 3.5-inch drives.



Key Advantages

- Stores 2^x the Tier 1 data over previous generation without increasing drive count
- Enables Tier 1 applications to process transactions more quickly
- Best-in-class idle power for more efficient storage operations
- Industry's highest MTBF at 2M hours
- Self-Encrypting Drive (SED)³ and FIPS SED⁴ options cut IT drive retirement costs and help protect data at rest.

Best-Fit Applications

- High-performance Tier 1 enterprise servers
- Blade, rack and tower servers hosting transaction-based applications
- Power- and space-constrained data centers
- Compliance and data security initiatives

CAPACITY	500-BAY MODEL	INTERFACE	CACHE
450GB	ST450MP0004	6Gb/s SAS	128MB
450GB	ST450MP0014 ¹	6Gb/s SAS	128MB
300GB	ST300MP0004	6Gb/s SAS	128MB
300GB	ST300MP0014 ¹	6Gb/s SAS	128MB

CAPACITY	500-BAY MODEL	INTERFACE	CACHE
600GB	ST600MP0034	6Gb/s SAS	128MB
600GB	ST600MP0044 ¹	6Gb/s SAS	128MB
600GB	ST600MP0054 ²	6Gb/s SAS	128MB
450GB	ST450MP0034	6Gb/s SAS	128MB
450GB	ST450MP0044 ¹	6Gb/s SAS	128MB
300GB	ST300MP0034	6Gb/s SAS	128MB
300GB	ST300MP0044 ¹	6Gb/s SAS	128MB

CAPACITY	4-K-NATIVE MODEL	INTERFACE	CACHE
600GB	ST600MP0064	6Gb/s SAS	128MB
600GB	ST600MP0074 ¹	6Gb/s SAS	128MB
600GB	ST600MP0084 ²	6Gb/s SAS	128MB
450GB	ST450MP0064	6Gb/s SAS	128MB
450GB	ST450MP0074 ¹	6Gb/s SAS	128MB
300GB	ST300MP0064	6Gb/s SAS	128MB
300GB	ST300MP0074 ¹	6Gb/s SAS	128MB



¹ Depending on configuration, the maximum capacity of the drive may vary. For more information, please contact your local Seagate representative.
² Depending on configuration, the maximum capacity of the drive may vary. For more information, please contact your local Seagate representative.
³ SED (Self-Encrypting Drive) is a feature that encrypts data at rest. It is not a security protocol and does not provide any level of protection against data loss or theft.
⁴ FIPS (Federal Information Processing Standards) is a set of standards for cryptographic modules and algorithms. It is not a security protocol and does not provide any level of protection against data loss or theft.

Enterprise Performance 10K HDD

Seagate Enterprise Performance 10K HDDs deliver the optimal balance of capacity, performance and power in a 10K-RPM, 2.5-inch enterprise drive.



Key Advantages

- † Highest-capacity enterprise SFF hard drive (up to 1.2TB)
- † PowerChoice™ technology reduces power consumption
- † Protection Information (PI) detects corruption of data in flight between the host system and the drive¹
- † Self-Encrypting Drive (SED)² and FIPS 140-2 certified SED³ cut IT drive retirement costs and protect data at rest. FIPS options meet government encryption compliance standards.

Best-Fit Applications

- † Mission-critical servers and external storage arrays
- † Power- and space-constrained data centers
- † Compliance or data security initiatives

CAPACITY	SERIAL NUMBER MODEL	INTERFACE	CHIE
120GB	ST1200MM0017	6Gb/s SAS	64MB
120GB	ST1200MM0027 ¹	6Gb/s SAS	64MB
300GB	ST3000MM002 ¹	6Gb/s SAS	64MB
300GB	ST3000MM003 ¹	6Gb/s SAS	64MB
300GB	ST3000MM003S	6Gb/s SAS	64MB
300GB	ST3000MM003S ¹	6Gb/s SAS	64MB
300GB	ST3000MM003S ²	6Gb/s SAS	64MB
300GB	ST3000MM003S ³	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁴	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁵	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁶	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁷	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁸	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁹	6Gb/s SAS	64MB
300GB	ST3000MM003S ¹⁰	6Gb/s SAS	64MB
300GB	ST3000MM003S ¹¹	6Gb/s SAS	64MB
300GB	ST3000MM003S ¹²	6Gb/s SAS	64MB
300GB	ST3000MM003S ¹³	6Gb/s SAS	64MB
300GB	ST3000MM003S ¹⁴	6Gb/s SAS	64MB
300GB	ST3000MM003S ¹⁵	6Gb/s SAS	64MB
300GB	ST3000MM003S ¹⁶	6Gb/s SAS	64MB
300GB	ST3000MM003S ¹⁷	6Gb/s SAS	64MB
300GB	ST3000MM003S ¹⁸	6Gb/s SAS	64MB
300GB	ST3000MM003S ¹⁹	6Gb/s SAS	64MB
300GB	ST3000MM003S ²⁰	6Gb/s SAS	64MB
300GB	ST3000MM003S ²¹	6Gb/s SAS	64MB
300GB	ST3000MM003S ²²	6Gb/s SAS	64MB
300GB	ST3000MM003S ²³	6Gb/s SAS	64MB
300GB	ST3000MM003S ²⁴	6Gb/s SAS	64MB
300GB	ST3000MM003S ²⁵	6Gb/s SAS	64MB
300GB	ST3000MM003S ²⁶	6Gb/s SAS	64MB
300GB	ST3000MM003S ²⁷	6Gb/s SAS	64MB
300GB	ST3000MM003S ²⁸	6Gb/s SAS	64MB
300GB	ST3000MM003S ²⁹	6Gb/s SAS	64MB
300GB	ST3000MM003S ³⁰	6Gb/s SAS	64MB
300GB	ST3000MM003S ³¹	6Gb/s SAS	64MB
300GB	ST3000MM003S ³²	6Gb/s SAS	64MB
300GB	ST3000MM003S ³³	6Gb/s SAS	64MB
300GB	ST3000MM003S ³⁴	6Gb/s SAS	64MB
300GB	ST3000MM003S ³⁵	6Gb/s SAS	64MB
300GB	ST3000MM003S ³⁶	6Gb/s SAS	64MB
300GB	ST3000MM003S ³⁷	6Gb/s SAS	64MB
300GB	ST3000MM003S ³⁸	6Gb/s SAS	64MB
300GB	ST3000MM003S ³⁹	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁴⁰	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁴¹	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁴²	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁴³	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁴⁴	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁴⁵	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁴⁶	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁴⁷	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁴⁸	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁴⁹	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁵⁰	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁵¹	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁵²	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁵³	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁵⁴	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁵⁵	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁵⁶	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁵⁷	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁵⁸	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁵⁹	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁶⁰	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁶¹	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁶²	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁶³	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁶⁴	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁶⁵	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁶⁶	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁶⁷	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁶⁸	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁶⁹	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁷⁰	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁷¹	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁷²	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁷³	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁷⁴	6Gb/s SAS	64MB
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300GB	ST3000MM003S ⁸²	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁸³	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁸⁴	6Gb/s SAS	64MB
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300GB	ST3000MM003S ⁸⁸	6Gb/s SAS	64MB
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300GB	ST3000MM003S ⁹³	6Gb/s SAS	64MB
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300GB	ST3000MM003S ⁹⁵	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁹⁶	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁹⁷	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁹⁸	6Gb/s SAS	64MB
300GB	ST3000MM003S ⁹⁹	6Gb/s SAS	64MB
300GB	ST3000MM003S ¹⁰⁰	6Gb/s SAS	64MB

Cheetah® 15K

The Seagate Cheetah 15K drive provides high performance and reliability in legacy 3.5-inch mission-critical storage.



Key Advantages

- † Sustained data rate of up to 204MB/s
- † Industry's highest 3.5-inch drive reliability
- † PowerTrim™ technology optimizes power consumption
- † Self-Encrypting Drive (SED)² and FIPS 140-2 certified SED³ cut IT drive retirement costs and protect data. FIPS options meet government encryption compliance standards.

Best-Fit Applications

- † Business and transaction processing
- † Email and decision support
- † Storage Area Networks (SAN)
- † Network Attached Storage (NAS)
- † Internet and e-commerce

CAPACITY	SERIAL NUMBER MODEL	INTERFACE	CHIE
60GB	ST36000573S	6Gb/s SAS	16MB
60GB	ST36000573S ¹	6Gb/s SAS	16MB
60GB	ST36000573S ²	6Gb/s SAS	16MB
60GB	ST36000573S ³	6Gb/s SAS	16MB
60GB	ST36000573S ⁴	6Gb/s SAS	16MB
60GB	ST36000573S ⁵	6Gb/s SAS	16MB
60GB	ST36000573S ⁶	6Gb/s SAS	16MB
60GB	ST36000573S ⁷	6Gb/s SAS	16MB
60GB	ST36000573S ⁸	6Gb/s SAS	16MB
60GB	ST36000573S ⁹	6Gb/s SAS	16MB
60GB	ST36000573S ¹⁰	6Gb/s SAS	16MB
60GB	ST36000573S ¹¹	6Gb/s SAS	16MB
60GB	ST36000573S ¹²	6Gb/s SAS	16MB
60GB	ST36000573S ¹³	6Gb/s SAS	16MB
60GB	ST36000573S ¹⁴	6Gb/s SAS	16MB
60GB	ST36000573S ¹⁵	6Gb/s SAS	16MB
60GB	ST36000573S ¹⁶	6Gb/s SAS	16MB
60GB	ST36000573S ¹⁷	6Gb/s SAS	16MB
60GB	ST36000573S ¹⁸	6Gb/s SAS	16MB
60GB	ST36000573S ¹⁹	6Gb/s SAS	16MB
60GB	ST36000573S ²⁰	6Gb/s SAS	16MB
60GB	ST36000573S ²¹	6Gb/s SAS	16MB
60GB	ST36000573S ²²	6Gb/s SAS	16MB
60GB	ST36000573S ²³	6Gb/s SAS	16MB
60GB	ST36000573S ²⁴	6Gb/s SAS	16MB
60GB	ST36000573S ²⁵	6Gb/s SAS	16MB
60GB	ST36000573S ²⁶	6Gb/s SAS	16MB
60GB	ST36000573S ²⁷	6Gb/s SAS	16MB
60GB	ST36000573S ²⁸	6Gb/s SAS	16MB
60GB	ST36000573S ²⁹	6Gb/s SAS	16MB
60GB	ST36000573S ³⁰	6Gb/s SAS	16MB
60GB	ST36000573S ³¹	6Gb/s SAS	16MB
60GB	ST36000573S ³²	6Gb/s SAS	16MB
60GB	ST36000573S ³³	6Gb/s SAS	16MB
60GB	ST36000573S ³⁴	6Gb/s SAS	16MB
60GB	ST36000573S ³⁵	6Gb/s SAS	16MB
60GB	ST36000573S ³⁶	6Gb/s SAS	16MB
60GB	ST36000573S ³⁷	6Gb/s SAS	16MB
60GB	ST36000573S ³⁸	6Gb/s SAS	16MB
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60GB	ST36000573S ⁴⁰	6Gb/s SAS	16MB
60GB	ST36000573S ⁴¹	6Gb/s SAS	16MB
60GB	ST36000573S ⁴²	6Gb/s SAS	16MB
60GB	ST36000573S ⁴³	6Gb/s SAS	16MB
60GB	ST36000573S ⁴⁴	6Gb/s SAS	16MB
60GB	ST36000573S ⁴⁵	6Gb/s SAS	16MB
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60GB	ST36000573S ⁴⁷	6Gb/s SAS	16MB
60GB	ST36000573S ⁴⁸	6Gb/s SAS	16MB
60GB	ST36000573S ⁴⁹	6Gb/s SAS	16MB
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60GB	ST36000573S ⁵³	6Gb/s SAS	16MB
60GB	ST36000573S ⁵⁴	6Gb/s SAS	16MB
60GB	ST36000573S ⁵⁵	6Gb/s SAS	16MB
60GB	ST36000573S ⁵⁶	6Gb/s SAS	16MB
60GB	ST36000573S ⁵⁷	6Gb/s SAS	16MB
60GB	ST36000573S ⁵⁸	6Gb/s SAS	16MB
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60GB	ST36000573S ⁶⁴	6Gb/s SAS	16MB
60GB	ST36000573S ⁶⁵	6Gb/s SAS	16MB
60GB	ST36000573S ⁶⁶	6Gb/s SAS	16MB
60GB	ST36000573S ⁶⁷	6Gb/s SAS	16MB
60GB	ST36000573S ⁶⁸	6Gb/s SAS	16MB
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60GB	ST36000573S ⁷¹	6Gb/s SAS	16MB
60GB	ST36000573S ⁷²	6Gb/s SAS	16MB
60GB	ST36000573S ⁷³	6Gb/s SAS	16MB
60GB	ST36000573S ⁷⁴	6Gb/s SAS	16MB
60GB	ST36000573S ⁷⁵	6Gb/s SAS	16MB
60GB	ST36000573S ⁷⁶	6Gb/s SAS	16MB
60GB	ST36000573S ⁷⁷	6Gb/s SAS	16MB
60GB	ST36000573S ⁷⁸	6Gb/s SAS	16MB
60GB	ST36000573S ⁷⁹	6Gb/s SAS	16MB
60GB	ST36000573S ⁸⁰	6Gb/s SAS	16MB
60GB	ST36000573S ⁸¹	6Gb/s SAS	16MB
60GB	ST36000573S ⁸²	6Gb/s SAS	16MB
60GB	ST36000573S ⁸³	6Gb/s SAS	16MB
60GB	ST36000573S ⁸⁴	6Gb/s SAS	16MB
60GB	ST36000573S ⁸⁵	6Gb/s SAS	16MB
60GB	ST36000573S ⁸⁶	6Gb/s SAS	16MB
60GB	ST36000573S ⁸⁷	6Gb/s SAS	16MB
60GB	ST36000573S ⁸⁸	6Gb/s SAS	16MB
60GB	ST36000573S ⁸⁹	6Gb/s SAS	16MB
60GB	ST36000573S ⁹⁰	6Gb/s SAS	16MB
60GB	ST36000573S ⁹¹	6Gb/s SAS	16MB
60GB	ST36000573S ⁹²	6Gb/s SAS	16MB
60GB	ST36000573S ⁹³	6Gb/s SAS	16MB
60GB	ST36000573S ⁹⁴	6Gb/s SAS	16MB
60GB	ST36000573S ⁹⁵	6Gb/s SAS	16MB
60GB	ST36000573S ⁹⁶	6Gb/s SAS	16MB
60GB	ST36000573S ⁹⁷	6Gb/s SAS	16MB
60GB	ST36000573S ⁹⁸	6Gb/s SAS	16MB
60GB	ST36000573S ⁹⁹	6Gb/s SAS	16MB
60GB	ST36000573S ¹⁰⁰	6Gb/s SAS	16MB

Enterprise Capacity 3.5 HDD

The Seagate Enterprise Capacity 3.5 HDDs help data centers meet the demanding growth of unstructured data.

Key Advantages

- Highest-capacity enterprise drive for maximum density server and storage solutions
- SAS and SATA interfaces with 24x7 reliability
- Predictable 7200-RPM performance even in the most rugged multi-drive environments
- Improved power and cooling efficiencies with low power consumption and on-demand PowerChoice™ technology
- Protect your data and ease data disposal costs and management with the Self-Encrypting Drive (SED) and FIPS 140-2 certified SED^{1,2}

Best-Fit Applications

- High-capacity RAID storage
- Mainstream enterprise external storage (SAN, NAS, DAS)
- Cloud bulk data storage
- Enterprise backup and restore—D2D, virtual tape
- Centralized surveillance



CAPACITY	SER. NAT'L. MODEL	INTERFACE	CACHE
4TB	ST4000NM0033	SATA 6Gb/s	128MB
4TB	ST4000NM0057 ¹	SATA 6Gb/s	128MB
4TB	ST4000NM0072 ^{1,2}	SATA 6Gb/s	128MB
4TB	ST4000NM0023	6Gb/s SAS	128MB
4TB	ST4000NM0043 ¹	6Gb/s SAS	128MB
4TB	ST4000NM0063 ^{1,2}	6Gb/s SAS	128MB
3TB	ST3000NM0033	SATA 6Gb/s	128MB
3TB	ST3000NM0057 ¹	SATA 6Gb/s	128MB
3TB	ST3000NM0023	6Gb/s SAS	128MB
3TB	ST3000NM0043 ¹	6Gb/s SAS	128MB
3TB	ST3000NM0063 ^{1,2}	6Gb/s SAS	128MB
2TB	ST2000NM0033	SATA 6Gb/s	128MB
2TB	ST2000NM0057 ¹	SATA 6Gb/s	128MB
2TB	ST2000NM0023	6Gb/s SAS	128MB
2TB	ST2000NM0043 ¹	6Gb/s SAS	128MB
2TB	ST2000NM0063 ^{1,2}	6Gb/s SAS	128MB
1TB	ST1000NM0033	SATA 6Gb/s	128MB
1TB	ST1000NM0057 ¹	SATA 6Gb/s	128MB
1TB	ST1000NM0023	6Gb/s SAS	128MB
1TB	ST1000NM0043 ¹	6Gb/s SAS	128MB
1TB	ST1000NM0063 ^{1,2}	6Gb/s SAS	128MB

ENTERPRISE STORAGE

Constellation®

The Seagate Constellation drive is the only 2.5-inch enterprise-class hard drive delivering both 1TB capacities and enterprise reliability.

Key Advantages

- Maximizes data center footprint
- Energy-efficient storage at under 3.9W (idle)
- Highest nearline reliability with an MTBF of 1.4M hours
- Self-Encrypting Drive (SED)¹ and FIPS 140-2 certified SED¹ cut IT drive retirement costs and protect data
- FIPS options meet government encryption compliance standards.

Best-Fit Applications

- Storage-hungry business applications
- Storage area networks and network attached storage
- Maximum-capacity servers and blade servers
- Rich media content storage
- Enterprise backup and restore—D2D, virtual tape
- Cloud computing



CAPACITY	SER. NAT'L. MODEL	INTERFACE	CACHE
1TB	ST91000640NS	SATA 6Gb/s	64MB
1TB	ST91000641NS	SATA 6Gb/s	64MB
1TB	ST91000642NS ¹	SATA 6Gb/s	64MB
1TB	ST91000640SS	6Gb/s SAS	64MB
1TB	ST91000641SS	6Gb/s SAS	64MB
1TB	ST91000642SS ¹	6Gb/s SAS	64MB
500GB	ST9500620NS	SATA 6Gb/s	64MB
500GB	ST9500621NS	SATA 6Gb/s	64MB
500GB	ST9500622NS ¹	SATA 6Gb/s	64MB
500GB	ST9500620SS	6Gb/s SAS	64MB
500GB	ST9500621SS	6Gb/s SAS	64MB
500GB	ST9500622SS ¹	6Gb/s SAS	64MB
250GB	ST9250610NS	SATA 6Gb/s	64MB
250GB	ST9250611NS	SATA 6Gb/s	64MB
250GB	ST9250612NS ¹	SATA 6Gb/s	64MB

Terascale™ HDD Constellation® CS

The Seagate Terascale HDD and Constellation CS are designed for large Web-scale data centers where low-cost, low-power and high-capacity storage is critical.



Key Advantages

- † Affordable storage for 24*7 multi-drive replicated environments
- † High vibration tolerance for reliable enterprise-class performance
- † Low power and cooling costs with the lowest 3.5-inch enterprise drive operating power
- † Advanced format logical block management for industry-leading data integrity

Best-Fit Applications

- † Web-scale computing
- † Cloud storage servers and arrays
- † Cloud backup storage
- † Direct-attached external storage (DAS)
- † Network-attached storage (NAS)

CAPACITY	SERIAL MODEL	INTERFACE	CAO/E
4TB	ST4000NC000*	SATA 6Gb/s	64MB
4TB	ST4000NC001	SATA 6Gb/s	64MB
3TB	ST3000NC002	SATA 6Gb/s	64MB
3TB	ST3000NC000*	SATA 6Gb/s	64MB
2TB	ST2000NC001	SATA 6Gb/s	64MB
2TB	ST2000NC000*	SATA 6Gb/s	64MB
1TB	ST1000NC001	SATA 6Gb/s	64MB
1TB	ST1000NC000*	SATA 6Gb/s	64MB



* One gigabyte (1 GB) equals one billion bytes (1,000,000,000 bytes). 1 TB equals one thousand billion bytes (1,000,000,000,000 bytes).
† Complete product specifications available at www.seagate.com.

Desktop Storage Solutions

Seagate has a distinguished history in consistently delivering innovative technologies, super-sized capacities, low power and blazing-fast performance. Seagate desktop drives offer excellent performance at all levels.

DESKTOP STORAGE



	DESKTOP SSHD	DESKTOP SHDD INTERNAL KIT	DESKTOP HDD	DESKTOP 3.5 INCH INTERNAL KIT
Legacy Name			Barracuda®	Barracuda
Application	Performance	Performance	Mainstream	Mainstream
Description	Solid state hybrid drive delivers SSD-like performance without sacrificing capacity	The easy way to upgrade or add storage capacity to desktop computers to get solid state speed for fast, responsive system performance	Tuned performance for low-power, mainstream and high-performance desktop computing	The fast, powerful and easy way to upgrade or add storage capacity to desktop computers
Capacity ¹	1TB to 4TB	1TB to 4TB	250GB to 4TB	500GB to 4TB
Interface	SATA 6Gb/s	SATA 6Gb/s	SATA 6Gb/s	SATA 3Gb/s, SATA 6Gb/s
Form Factor	3.5 inch	3.5 inch	3.5 inch	3.5 inch
Reliability	<1% AFR	<1% AFR	<1% AFR	<1% AFR
Cache	64MB	64MB	16MB to 64M	16MB to 64M
Power (idle)	<3.3W to <3.9W	<3.3W to <3.9W	4.0W to 5.8W	
Product	Desktop SSHD	Desktop SHDD Internal Kit	Desktop HDD	Desktop 3.5 inch Internal Kit
OptiCache™ Technology			X	X
Solid State Hybrid	X	X		
Mounting Hardware and Cables		X		X
Compatible with Windows 8 ²	X	X	X	X
Energy-Saving Features	X	X	X	X
RoHS Compliance	X	X	X	X

¹ One gigabyte = 1024 megabytes. 1TB equals one trillion bytes and one terabyte. ² The compatibility of Seagate products that are compatible with Windows 8. Visit <http://www.seagate.com/compatibility> for more information.

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Desktop SSHD

Seagate Desktop SSHD (solid state hybrid drive) delivers SSD-like performance and massive capacities at an affordable price.

Key Advantages

- † First SSHD in a 3.5-inch form factor
- † SATA 6Gb/s with NCQ for interface speed
- † Up to 3x faster than a traditional HDD¹
- † All-in-one design for ease of installation
- † Installs and operates like a standard hard drive
- † Massive 1TB or 2TB capacities combined with SSD-like performance²

Best-Fit Applications

- † Desktop PCs
- † Workstations
- † High-performance direct-attached storage (DAS) devices



CAPACITY	MODEL	INTERFACE	CACHE
4TB	ST2000D001	SATA 6Gb/s	64MB
2TB	ST2000D001	SATA 6Gb/s	64MB
1TB	ST1000D001	SATA 6Gb/s	64MB

Desktop 3.5-Inch Internal Kit

Seagate 3.5-inch internal drives are the fast, powerful, and easy way to upgrade or add storage capacity to desktop computers.

Key Advantages

- † Quiet, ultra-high performance
- † DiscWizard™ software makes installation a snap
- † Built-in self-monitoring technology helps ensure maximum reliability
- † Desktop solid state hybrid model offers SSD-like performance with the capacity of a hard drive

Best-Fit Applications

- † Gaming PCs
- † Workstations
- † High-end PCs
- † Desktop RAID
- † Mainstream/office PCs



CAPACITY	KIT NUMBER	INTERFACE	CACHE
4TB	STBD4000400	SATA 6Gb/s	64MB
3TB	STBD3000100	SATA 6Gb/s	64MB
2TB	STBD2000101	SATA 6Gb/s	64MB
1TB	ST10009N1AS-RK	SATA 6Gb/s	64MB
500GB	ST350064AS-RK	SATA 3Gb/s	64MB

PACKAGE DIMENSIONS: 7.38-in L x 5.88-in W x 2.88-in D (187mm x 149mm x 73mm)

CAPACITY	KIT NUMBER	INTERFACE	NCQ/FLASH
2TB	STC12000400	SATA 6Gb/s	8GB

PACKAGE DIMENSIONS: 5.68-in L x 7.38-in W x 2.88-in D (149.35mm x 187.45mm x 73.15mm)

Desktop HDD

Seagate Desktop HDDs give you the Power of One with 1TB-per-disk technology and one drive platform for every capacity and application.

Key Advantages

- † Up to 4TB capacity
- † AcuTrac™ and OptiCache™ technologies deliver dependable overall performance.
- † Free Seagate DiscWizard™ software

Best-Fit Applications

- † Desktop or all-in-one PCs and home servers
- † PC-based gaming systems
- † Direct-attached external storage devices (DAS)



CAPACITY	MODEL	INTERFACE	CACHE
4TB	ST4000DM000	SATA 6Gb/s NCQ	64MB
3TB	ST3000DM001	SATA 6Gb/s NCQ	64MB
2TB	ST2000DM001	SATA 6Gb/s NCQ	64MB
1TB	ST1000DM003	SATA 6Gb/s NCQ	64MB
800GB	ST5000DM002	SATA 6Gb/s NCQ	16MB
320GB	ST320DM000	SATA 6Gb/s NCQ	16MB
250GB	ST250DM000	SATA 6Gb/s NCQ	16MB



¹ Data generated in GB, results are based on sequential read/write of 1TB model and 1TB test data using following test methodology.
² Performance may vary depending on drive's technology and function test methodology.
 © 2016, model subject to change

Mobile Storage Solutions

Seagate laptop and tablet drives address every mobile market need, delivering superior performance, reliability and value. Feature-rich with innovative options, the Seagate mobile lineup also includes self-encryption and FIPS 140-2 validated models.

MOBILE STORAGE



LAPTOP SSD AND LAPTOP THIN SSD LAPTOP SSD INTERNAL KIT LAPTOP 2.5-INCH INTERNAL KIT MOMENTUS® THIN LAPTOP ULTRATHIN HDD ULTRA MOBILE HDD

Legacy Name	Momentus XT	Momentus XT	Momentus Internal Kit			
Application	Performance	Performance	Performance	Mainstream, Slim Computing	Slim Computing	Slim, Robust Computing
Description	Solid state hybrid drives deliver SSD-like performance without sacrificing capacity	The easy way to upgrade or add storage capacity to laptop computers to get solid state speed with capacity of a hard disk drive	A complete upgrade kit to transform your system to high performance or just add capacity	The 2.5-inch drive for laptops and notebooks	Affordable, high-capacity storage that is thinner than a pencil	Brings robust storage ideal for ultra-slim tablet, convertible and detachable applications in a 5mm form factor
Capacity ¹	500GB and 1TB	500GB and 1TB	250GB and 1TB	250GB, 320GB and 500GB	320GB and 500GB	500GB
Interface	SATA 6Gb/s	SATA 6Gb/s	SATA 6Gb/s	SATA 6Gb/s	SATA 6Gb/s	SATA 6Gb/s
Form Factor/ 2-H-Height	2.5-inch/ 9.5mm, 7mm	2.5-inch/ 9.5mm, 7mm	2.5-inch/9.5mm	2.5-inch/7mm	2.5-inch/5mm	2.5-inch/5mm
Reliability	0.48% AFR	0.48% AFR	0.48% AFR	0.48% AFR		
Cache	64MB	64MB	16MB	16MB	16MB	16MB
Power (Idle)	0.9W	0.9W	0.6W to 0.8W	0.43W	0.48W	0.48W
Product	Laptop SSD and Laptop Thin SSD	Laptop SSD Internal Kit	Laptop 2.5-inch Internal Kit	Momentus® Thin	Laptop Ultrathin HDD	Ultra Mobile HDD
Self-Encrypting Drive (SED) with Instant Secure Erase ²				X	X	
FIPS 140-2 SED Option ³				X		
Drop Sensor Options						X
Solid State Hybrid	X	X				
Compatible with Windows 8 ⁴	X	X	X	X	X	X
Energy-Saving Features	X	X		X	X	X
RoHS Compliance	X	X	X	X	X	X

¹One capacity in SED model (the other model contains 16MB of DRAM cache and 500GB of HDD capacity).
²Self-Encrypting Drive (SED) models may require BIOS updates to be installed.
³Some FIPS 140-2 models may require BIOS updates to be installed.
⁴For a complete list of supported operating systems, please visit the Seagate website at www.seagate.com.

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Laptop SSHD and Laptop Thin SSHD

The Seagate Laptop SSHD (1TB) and Laptop Thin SSHD (500GB) enable laptop PC users to enjoy solid state performance without sacrificing capacity.



Key Advantages

- Boots and performs like an SSD¹
- Up to 4x faster than a traditional HDD²
- SATA 6Gb/s with NCQ for interface speed
- All-in-one design for simplicity and ease of installation
- Works in any laptop or PC, any OS and any application
- Backed by a 3-year limited warranty

Best-Fit Applications

- Laptops and mobile workstations
- Desktop and tower workstations
- High-performance laptop and desktop gaming systems
- Small form factor all-in-one PCs

CAPACITY	MODEL	INTERFACE	CACHE
1TB	ST1000LM014	SATA 6Gb/s	64MB
500GB	ST500LM000	SATA 3Gb/s	64MB

Laptop Ultrathin HDD

The Seagate Laptop Ultrathin HDD is one of the thinnest and lightest laptop hard drives—5mm, 3.3 oz. and thinner than a pencil.



Key Advantages

- Affordable, high-capacity storage gives system builder options when integrating low profile storage into slim laptop and ultrabook solutions
- Compatible with every portable PC with a standard SATA 6Gb/s interface
- Get industry-leading cost-per-GB and cost-per-millimeter
- Seagate Secure³ Self-Encrypting Drive options⁴

Best-Fit Applications

- Slim laptops or ultrabooks
- Extending high-capacity, affordable storage into other applications and slim devices
- Backup storage

CAPACITY	MODEL	INTERFACE	CACHE
400GB	ST500LT002	SATA 6Gb/s	16MB
500GB	ST500LT003	SATA 6Gb/s	16MB
320GB	ST320LT000	SATA 6Gb/s	16MB

Momentus[®] Thin

The 7mm, 2.5-inch drive enables slim computing for all types of mobile computing, from laptops to netbooks to smaller desktop PCs.



Key Advantages

- 7mm z-height form factor enables thin chassis design for all segments of laptop computing
- Seagate SmartAlign[™] technology provides a transition to 4K sectors without the need for software utilities.
- Self-Encrypting Drive⁵ options mitigate data breaches, comply with data protection regulations and preserve brand recognition
- Self-Encrypting Drive options with FIPS 140-2 certification⁶ are government-approved for the U.S. and Canadian governments

Best-Fit Applications

- Thin entry-level laptop PCs
- Thin high-end netbooks
- Thin ultraportables

CAPACITY	MODEL	INTERFACE	CACHE
400GB	ST500LT025 ⁷	SATA 6Gb/s	16MB
500GB	ST500LT019 ⁸	SATA 6Gb/s	16MB
500GB	ST500LT012	SATA 6Gb/s	16MB
320GB	ST320LT012	SATA 6Gb/s	16MB
250GB	ST250LT012	SATA 6Gb/s	16MB

Ultra Mobile HDD

Just 5mm thin and supported by a stainless steel design, the Seagate Ultra Mobile HDD is ready for mobility.



Key Advantages

- 500GB brings 7" more space to tablet applications at a fraction of the cost
- Zero-gravity sensors provide extra drop protection
- Improved shock and tolerance for gyroscopic motion supports even the intense maneuvers of gamers
- Just 3.3 oz.—about the weight of a lightbulb
- Couple with the Seagate Mobile Enablement Kit's Dynamic Data⁹ Driver for robust and responsive storage with no compromise to system battery life

Best-Fit Applications

- Tablets
- Convertible and detachable storage
- Ultra-mobile, ultra-portable storage expansion apps

CAPACITY	MODEL	INTERFACE	CACHE
500GB	ST500LT025	SATA 6Gb/s	16MB

Laptop 2.5-Inch Internal Kit

Seagate 2.5-inch internal drives deliver vast amounts of storage for adding capacity or upgrading drives in laptop computers.

Key Advantages

- Built for mobility
- Preserves battery life
- Large data cache
- Outstanding performance
- Laptop solid state hybrid model offers SSD-like performance with the capacity of a hard drive.

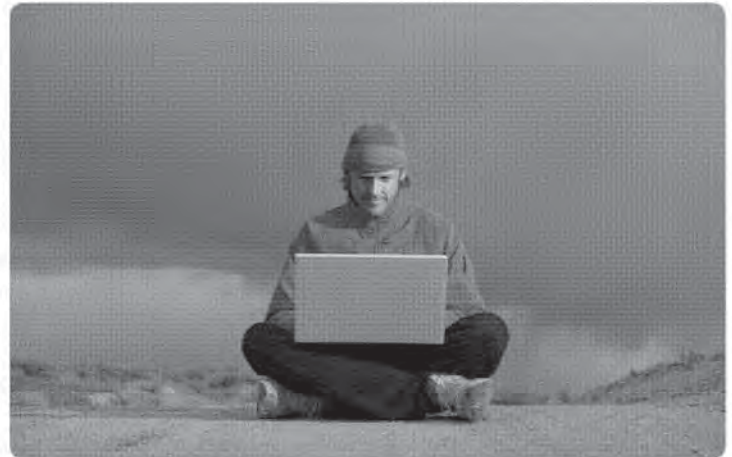
Best-Fit Applications

- Replacement laptop drives
- Laptop storage upgrades
- High-end laptops and workstations



CAPACITY	KIT NUMBER	INTERFACE	CACHE
1TB	STED1000100	SATA 3Gb/s	8MB
500GB	ST9000030NA1AS-RK	SATA 3Gb/s	16MB
500GB	ST9000030NA1AS-RK	SATA 3Gb/s	8MB
250GB	ST9000030NA1AS-RK	SATA 3Gb/s	8MB
PACKAGE DIMENSIONS	6.25-in L x 4.75-in W x 2.25-in D (159mm x 121mm x 57mm)		

LAPTOP SSD MODEL			
CAPACITY	KIT NUMBER	INTERFACE	MLC FLASH
1TB	STED1000400	SATA 6Gb/s	8GB
PACKAGE DIMENSIONS	6.25-in L x 4.75-in W x 2.25-in D (159mm x 121mm x 57mm)		



Specialty Storage Solutions

Storage solutions for NAS, DVRs and surveillance systems

Seagate has the expertise to build drives optimized for specialty environments, like Network Attached Storage (NAS), CE and video storage. Our global presence, business partnerships, technology leadership and industry understanding enable Seagate to deliver industry-leading products.

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SPECIALTY STORAGE



	NAS HDD	QNAS 3.5 HDD	VIDEO 3.5 HDD	VIDEO 2.5 HDD
Legacy Name			Pipeline® HD	Pipeline HD Mini
Application	Small NAS	Video Surveillance	Mainstream CE-DVR	Small form factor CE-DVR
Description	Best-performing, highest-capacity storage for 1- to 5-bay NAS systems	Optimized performance and improved reliability for video surveillance applications	Cool, quiet, low-power performance—perfect for high-definition consumer DVR applications	Cool, quiet, low-power—perfect for small form factor and power-sensitive designs
Capacity¹	2TB to 4TB	1TB to 8TB	250GB to 4TB	250GB to 500GB
Interface	SATA 6Gb/s	SATA 6Gb/s	SATA 3Gb/s, SATA 6Gb/s	SATA 3Gb/s
Form Factor	3.5-inch	3.5-inch	3.5-inch	2.5-inch
Simultaneous HD Streams Supported	—	—	up to 16	up to 12
Reliability	1M hours MTBF	<1% AFR	0.55% AFR	0.55% AFR
Cache	64MB	64MB	8MB to 64MB	16MB
Power (idle)	3.0W to 3.95W	3.38W to 5.4W (Idle2)	2.3W to 5.0W	0.65W
Product	NAS HDD	QNAS 3.5 HDD	Video 3.5 HDD	Video 2.5 HDD
Cool Operation		x	x	x
24x7 Operation Capable	x	x	x	x
Extremely Low Vibration	x			
NASWorks™ Technology	x			
Energy-Saving Features	x		x	x
RoHS Compliance	x	x	x	x

1 One syllable in GB equals one initial type and one final type of GB equals one initial type + one syllable + one final type.

STORAGE SOLUTIONS GUIDE 41

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NAS HDD

The Seagate NAS HDD fine-tunes the needs of 1- to 5-bay NAS systems to provide industry-leading performance and highest-capacity storage.

Key Advantages

- NASWorks™ technology supports custom error recovery controls, power management and vibration tolerance.
- NAS error recovery controls help to ensure drives are not dropped from the NAS and sent into a RAID rebuild.
- Improved vibration tolerance and emission in multi-drive systems with dual-plane balance.
- Advanced power management supports multiple power profiles for low-power, 24*7 performance.

Best-Fit Applications

- Home servers or desktop NAS solutions
- Small-business file sharing
- Backup servers



CAPACITY	MODEL	INTERFACE	CACHE
4TB	ST4000NA000	SATA 6Gb/s	64MB
6TB	ST6000NA000	SATA 6Gb/s	64MB
8TB	ST8000NA000	SATA 6Gb/s	64MB

Video 3.5 HDD

Seagate Video 3.5 HDDs deliver unprecedented levels of acoustic, power and vibration performance with room for hundreds of your favorite movies.

Key Advantages

- Quiet drive operation to enhance customer viewing and listening experiences
- 75°C, 24-hour operation capable
- Operational power consumption as low as 3.4W
- 2.0A spin-up current limited

Best-Fit Applications

- Consumer digital video recorders
- Media servers and centers
- Home theater PCs and servers
- Cable, satellite and IPTV set-top boxes



CAPACITY	MODEL	INTERFACE	CACHE
4TB	ST4000VX000	SATA 6Gb/s	64MB
6TB	ST6000VX000	SATA 6Gb/s	64MB
8TB	ST8000VX000	SATA 6Gb/s	64MB
10TB	ST10000VX000	SATA 6Gb/s	64MB
12TB	ST12000VX000	SATA 6Gb/s	64MB
14TB	ST14000VX000	SATA 6Gb/s	64MB
16TB	ST16000VX000	SATA 6Gb/s	64MB
18TB	ST18000VX000	SATA 6Gb/s	64MB
20TB	ST20000VX000	SATA 6Gb/s	64MB

SV35-Series

The Seagate SV35-series drives optimize performance, save power and improve reliability for video surveillance applications.

Key Advantages

- Higher areal density for cost-effective DVR applications
- Performance-tuned for seamless video applications
- Enterprise-class reliability for 24x7 video surveillance applications
- Built-in error recovery for non-stop streaming

Best-Fit Applications

- Video surveillance digital video recorder
- Video surveillance network digital video recorder
- Direct-attached JBOD video surveillance storage
- Network-attached JBOD video storage



CAPACITY	MODEL	INTERFACE	CACHE
3TB	ST3000VX000	SATA 6Gb/s	64MB
6TB	ST6000VX000	SATA 6Gb/s	64MB
12TB	ST12000VX000	SATA 6Gb/s	64MB

Video 2.5 HDD

Seagate Video 2.5 HDDs let you stream, record and play back your video content with unparalleled reliability and performance.

Key Advantages

- Virtually silent streaming performance as low as 19dB
- Built for 24*7 operation and low power consumption
- Small, 2.5-inch form factor allows system cost reduction and operational power savings
- Fanless design allows flexibility in a sleek system design
- 0.55% AFR supports longevity in demanding consumer electronic environments

Best-Fit Applications

- DVR and media center applications
- Home theater PCs
- Karaoke and audio jukeboxes
- Cable, satellite and IPTV set-top boxes
- In-camera or surveillance systems



CAPACITY	MODEL	INTERFACE	CACHE
500GB	ST500VT000	SATA 3Gb/s	16MB
1000GB	ST1000VT000	SATA 3Gb/s	16MB
2000GB	ST2000VT000	SATA 3Gb/s	16MB

Partner Resources and Benefits

The Seagate Partner Program (SPP) provides access to unique resources and benefits to help channel partners secure new opportunities and grow revenue and profitability.

As a registered SPP member, you enjoy the following exclusive features:

- † Password-protected portal
- † E-newsletter and regular news updates
- † New product evaluation unit program
- † Training and sales tools
- † Priority support

Start reaping the rewards of SPP membership—register today at www.seagate.com/www/partners

- † Complete the online form.
- † Click through and accept our standard agreement.



Service and Support

For information regarding products and services, visit www.seagate.com/about/contact-us/technical-support

Available services include:

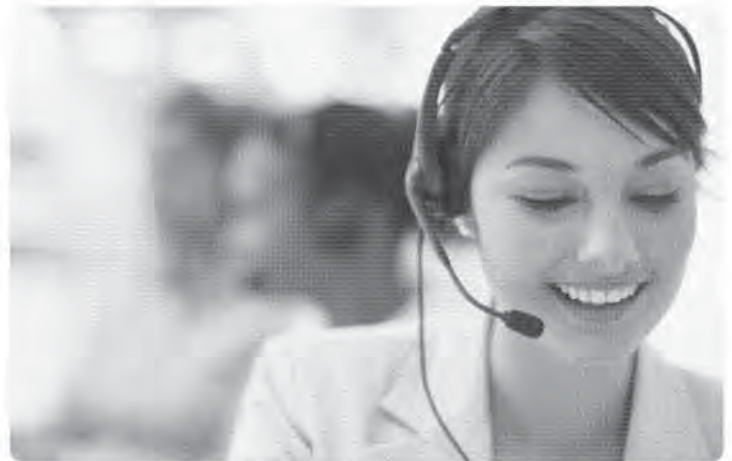
- † Presales and Technical Support
- † Global Support Services telephone numbers and business hours
- † Authorized Seagate Service Centers

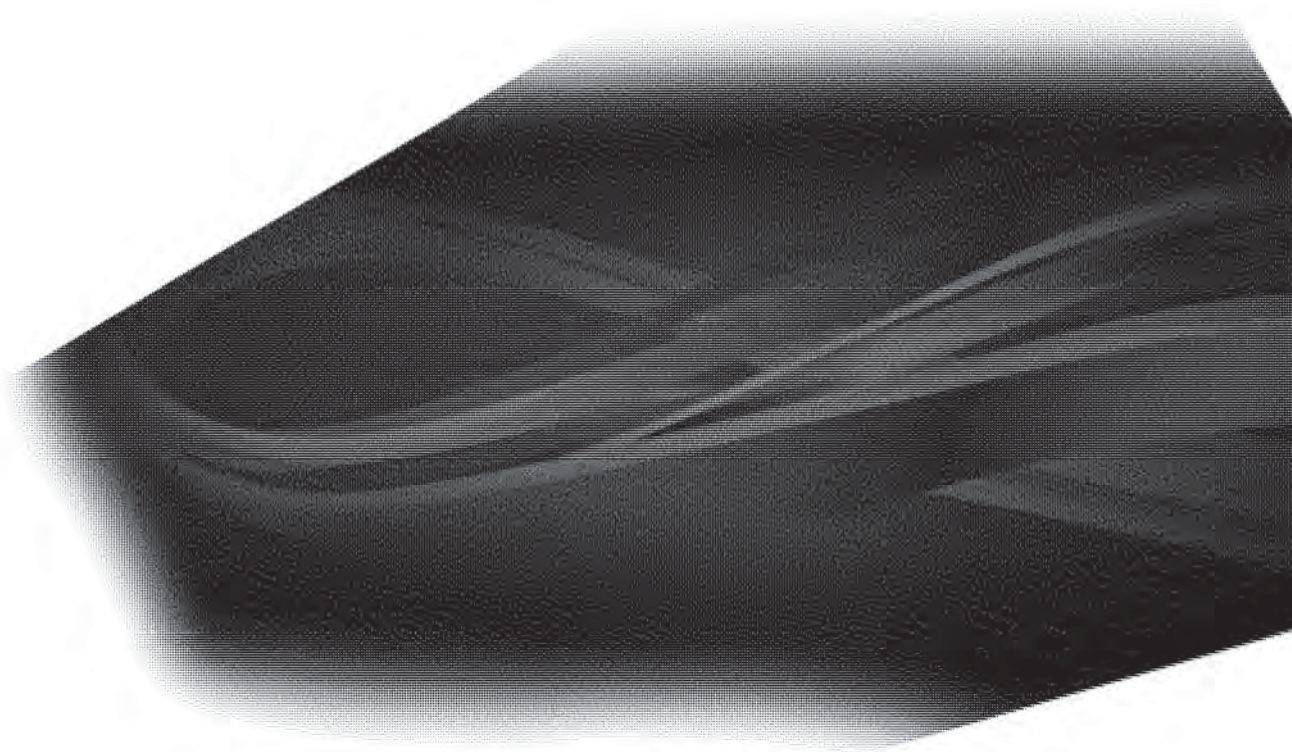
For information regarding Warranty Support, visit www.seagate.com/support/warranty-and-returns

For information regarding Data Recovery Services, visit www.seagate.com/services-software/

For Seagate OEM and Distribution partner portal, visit www.seagate.com/www/partners

For Seagate reseller portal, visit www.seagate.com/www/partners





Seagate Technology LLC
10200 South De Anza Boulevard
Cupertino, California 95014
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EXHIBIT 4



DESKTOP DRIVE DISQUE EXTERNE

Data Sheet

Seagate Backup Plus, easy backup for your digital life on your computer and the cloud

The Seagate® Backup Plus desktop drive simplifies backup for consumers who want to protect their entire digital life locally, in the cloud or from social networks. Via the Seagate Dashboard, use the *Protect* function to set up a one-click plan or customize your scheduled local backup. Keep multiple copies of your files in case disaster strikes.

With the *Save* feature, user-generated content can be backed up from your favorite social networks. Many people now use their smartphones to capture priceless moments. While these devices are handy and readily available, storage is not their strong suit. Capture a memory, post it on a social networking site and let the Seagate Dashboard automatically back up any content posted. Even if the file gets accidentally deleted from the device, another copy can be waiting.

The *Share* feature allows multiple files to be uploaded to social networks at once from your computer. The days of uploading individual files without creating a new album are gone! Simply select files to upload, choose where to post them and even add comments. Managing your social profile has never been easier.

Install the pre-loaded NTFS driver for Mac, and use the drive interchangeably between PC and Mac® computers without reformatting the drive. For even more flexibility, with the Seagate Backup Plus design, you can upgrade from the included USB 3.0 interface to Thunderbolt™ technology or FireWire® 800 with the available additional adapter.





DESKTOP DRIVE
DISQUE EXTERNE

Specifications

Retail Packaging	Product Dimensions	Box Dimensions	Master Carton Dimensions	Pallet Dimensions
Length (in/mm)	6.22/158	7.87/200	14.96/372	43.93/1116
Width (in/mm)	4.88/124	9.06/230	9.52/242	38.11/968
Depth (in/mm)	1.73/44	3.54/90	8.58/218	47.76/1213
Weight (lb/kg)	2.38/1.08	2.93/1.33	12.44/5.66	785/356.8
Quantities				
Boxes per Master Carton	4			
Master Cartons per Pallet	60			
Pallet Layers	5			
System Requirements:				
Windows® 7, Windows Vista®, Windows XP SP3 (32-bit and 64-bit) operating system or Mac OS X 10.6 or higher ¹				
SuperSpeed USB 3.0 port (required for USB 3.0 transfer speeds or backwards compatible with USB 2.0 ports at USB 2.0 transfer speeds) ²				
Inside the Box				
Seagate Backup Plus drive		4-foot USB 3.0 cable		
Seagate Dashboard pre-loaded on drive		Power adapter		
NTFS driver for Mac pre-loaded on drive ¹		Quick start guide		
USB 3.0 interface adapter with capacity gauge		2-year limited warranty		

Region	Product	Capacity ³	Model Number	LPC Code	Multi-Pack UPC
AMER	Backup Plus desktop drive	1TB	STCA1000100	763649040553	10763649040550
AMER	Backup Plus desktop drive	2TB	STCA2000100	763649040560	10763649040567
AMER	Backup Plus desktop drive	3TB	STCA3000101	763649040577	10763649040574
AMER	Backup Plus desktop drive	4TB	STCA4000100	763649040584	10763649040581

¹ Reformatting for Mac may be required.

² Compatibility may vary depending on user's hardware configuration and operating system.

³ One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one thousand million bytes when referring to drive capacity.

www.seagate.com

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EXHIBIT 5



DESKTOP DRIVE DISQUE EXTERNE

Data Sheet

Seagate Backup Plus, easy backup for your digital life on your computer, mobile devices and the cloud

The Seagate® Backup Plus desktop drive simplifies backup for consumers who want to help protect their entire digital life locally, in the cloud, from mobile devices or from social networks. Via the Seagate Dashboard, use the *Protect* function to set up a one-click plan or schedule your automatic local backup. Keep multiple copies of your files in case disaster strikes. Install the free Seagate Mobile Backup app on an iOS or Android mobile device to back up all of the pictures and videos from the device to the drive or the cloud. Back up mobile devices via a WiFi connection while at home, or use services like Dropbox or Google Drive while on-the-go, away from home.

With the *Save* feature, user-generated content can be backed up from your favorite social network sites. Capture a memory, post it on a social networking site and let the Seagate Dashboard automatically back up any content posted, even photos that you are tagged in.

The *Share* feature allows multiple files to be uploaded to social networks at once from your computer. Simply select files to upload, choose where to post them and even add comments. Managing your social profile has never been easier.

Install the pre-loaded NTFS driver for Mac, and use the drive interchangeably between Windows and Mac® computers without reformatting the drive.





DESKTOP DRIVE
DISQUE EXTERNE

Specifications

Retail Packaging	Product Dimensions	Box Dimensions	Master Carton Dimensions	Pallet Dimensions
Length (in/mm)	7.063/179.4	8.346/212	11.220/285	44.764/1137
Width (in/mm)	4.650/118.10	8.583/218	9.409/239	40.00/1016
Depth (in/mm)	1.634/41.50	2.677/68	8.780/223	47.99/1219
Weight (lb/kg)	1.892/860	2.750/1.250	11.656/5.298	789.518/358.872
Quantities				
Boxes per Master Carton	4			
Master Cartons per Pallet	64			
Pallet Layers	4			
System Requirements				
Windows® 8, Windows 7, Windows Vista®, Windows XP SP3 (32-bit and 64-bit) operating system or Mac OS X 10.6 or higher ¹				
SuperSpeed USB 3.0 port (required for USB 3.0 transfer speeds or backwards compatible with USB 2.0 ports at USB 2.0 transfer speeds) ²				
Seagate Mobile Backup app system requirements: iOS 6 or higher, Android 2.3 or higher				
What Is Included				
Seagate Backup Plus drive	Power adapter			
Seagate Dashboard pre-loaded on drive	Quick start guide			
NTFS driver for Mac pre-loaded on drive ³	2-year limited warranty			
4-foot USB 3.0 cable				

Region	Product	Capacity ³	Model Number ³	UPC Code	Multi-Pack UPC
AMER	Backup Plus desktop drive	2TB	STDT2000100	763649053423	10763649053420
AMER	Backup Plus desktop drive	3TB	STDT3000100	763649053430	10763649053437
AMER	Backup Plus desktop drive	4TB	STDT4000100	763649053447	10763649053444

¹ Reformatting for Mac may be required.

² Compatibility may vary depending on user's hardware configuration and operating system.

³ 1 Gb equals one billion bytes and one thousand bytes; 1 TB equals one thousand billion bytes (when referring to drive capacity).

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EXHIBIT 6



DESKTOP DRIVE DISQUE EXTERNE

Data Sheet

Seagate Backup Plus, easy backup for your digital life on your computer, mobile devices and the cloud

The Seagate® Backup Plus desktop drive simplifies backup for consumers who want to help protect their entire digital life locally, in the cloud, from mobile devices or from social networks. Via the Seagate Dashboard, use the *Protect* function to set up a one-click plan or schedule your automatic local backup. Keep multiple copies of your files in case disaster strikes. Install the free Seagate Mobile Backup app on an iOS or Android mobile device to back up all of the pictures and videos from the device to the drive or the cloud. Back up mobile devices via a WiFi connection while at home, or use services like Dropbox or Google Drive while on-the-go, away from home.

With the *Save* feature, user-generated content can be backed up from your favorite social network sites. Capture a memory, post it on a social networking site and let the Seagate Dashboard automatically back up any content posted, even photos that you are tagged in.

The *Share* feature allows multiple files to be uploaded to social networks at once from your computer. Simply select files to upload, choose where to post them and even add comments. Managing your social profile has never been easier.

Install the pre-loaded NTFS driver for Mac, and use the drive interchangeably between Windows and Mac® computers without reformatting the drive.





DESKTOP DRIVE
DISQUE EXTERNE

Specifications

Retail Packaging	Product Dimensions	Box Dimensions	Master Carton Dimensions	Pallet Dimensions
Length (in/mm)	7.063/179.4	8.346/212	11.220/285	44.764/1137
Width (in/mm)	4.650/118.10	8.583/218	9.409/239	40.00/1016
Depth (in/mm)	1.634/41.50	2.677/68	8.780/223	47.99/1219
Weight (lb/kg)	1.892/860	2.750/1.250	11.656/5.298	789.518/358.872
Quantities				
Boxes per Master Carton	4			
Master Cartons per Pallet	64			
Pallet Layers	4			
System Requirements				
Windows® 8, Windows 7, Windows Vista®, Windows XP SP3 (32-bit and 64-bit) operating system or Mac OS X 10.6 or higher ¹				
SuperSpeed USB 3.0 port (required for USB 3.0 transfer speeds or backwards compatible with USB 2.0 ports at USB 2.0 transfer speeds) ²				
Seagate Mobile Backup app system requirements: iOS 6 or higher, Android 2.3 or higher				
What Is Included				
Seagate Backup Plus drive	Power adapter			
Seagate Dashboard pre-loaded on drive	Quick start guide			
NIFS driver for Mac pre-loaded on drive ³	2-year limited warranty			
4-foot USB 3.0 cable				

Region	Product	Capacity ³	Model Number ¹	UPC Code	Multi-Pack UPC
AMER	Backup Plus desktop drive	2TB	STDT2000100	763649053423	10763649053420
AMER	Backup Plus desktop drive	3TB	STDT3000100	763649053430	10763649053437
AMER	Backup Plus desktop drive	4TB	STDT4000100	763649053447	10763649053444
AMER	Backup Plus desktop drive	5TB	STDT5000100	763649053454	10763649053451

¹ Reformatting for Mac may be required.

² Compatibility may vary depending on user's hardware configuration and operating system.

³ One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one thousand billion bytes when referring to drive capacity.

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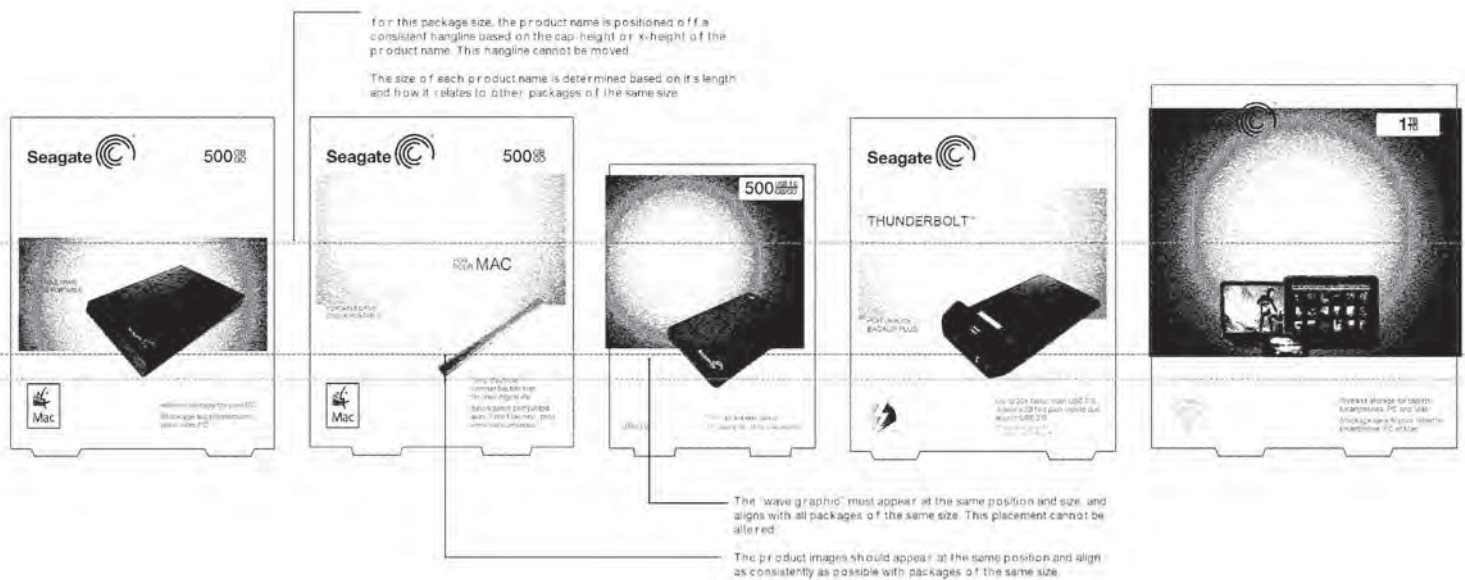
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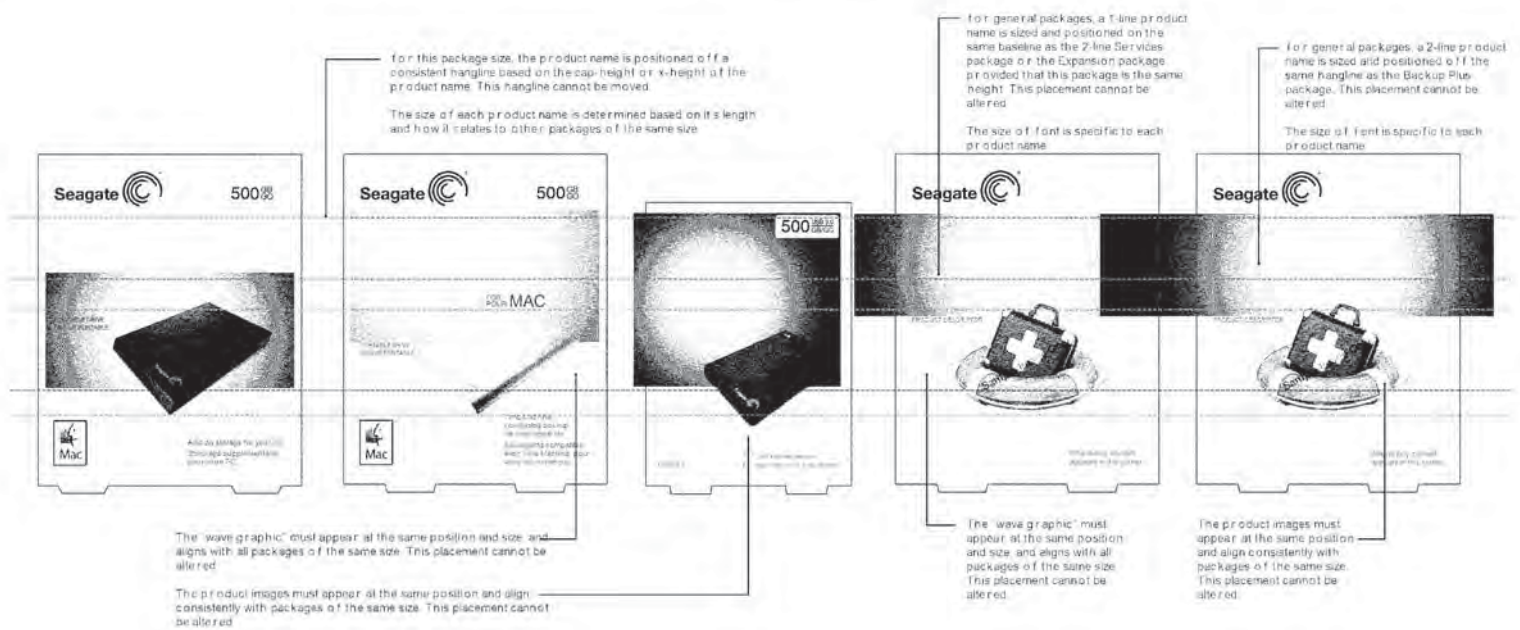
PORTABLE DRIVE PACKAGE REVIEW



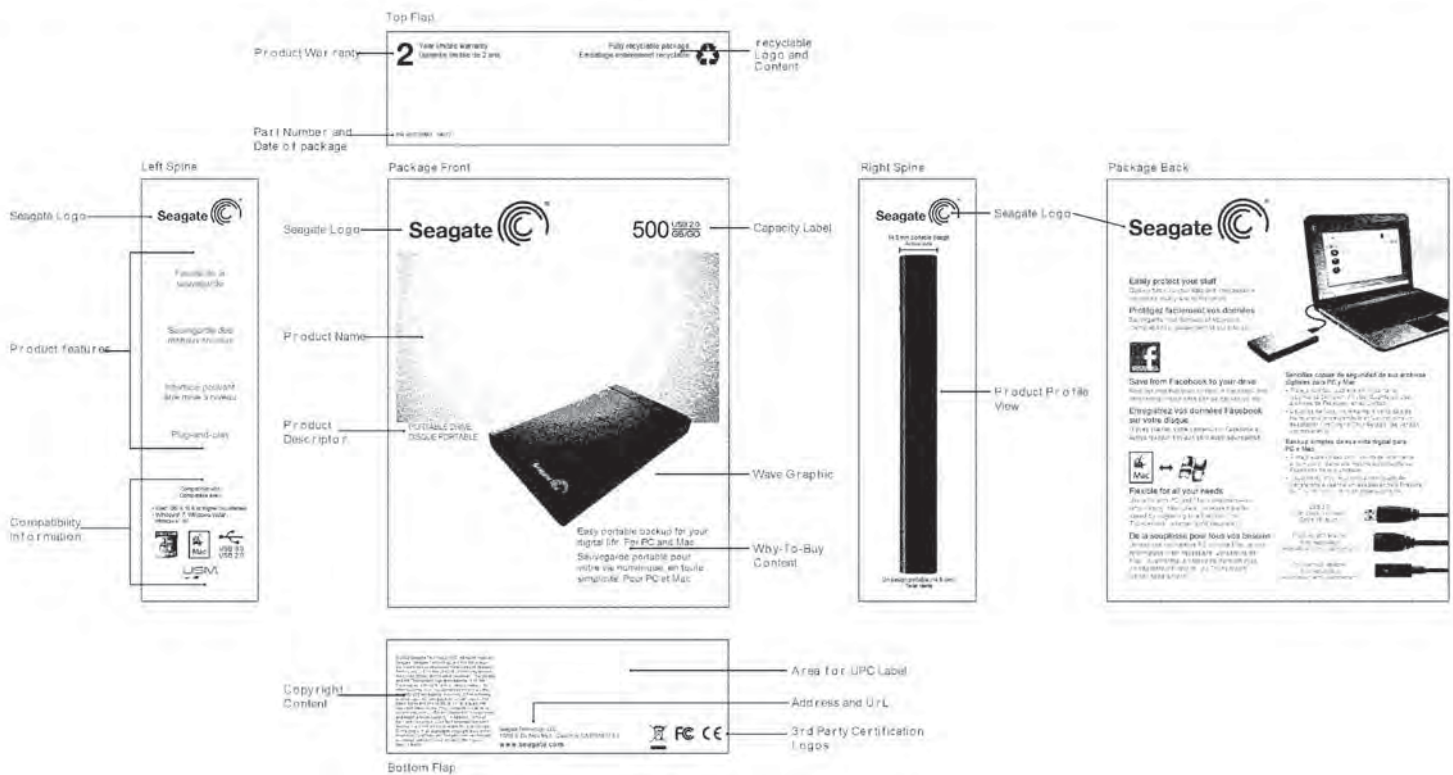
PACKAGE LINE UP AND ALIGNMENTS



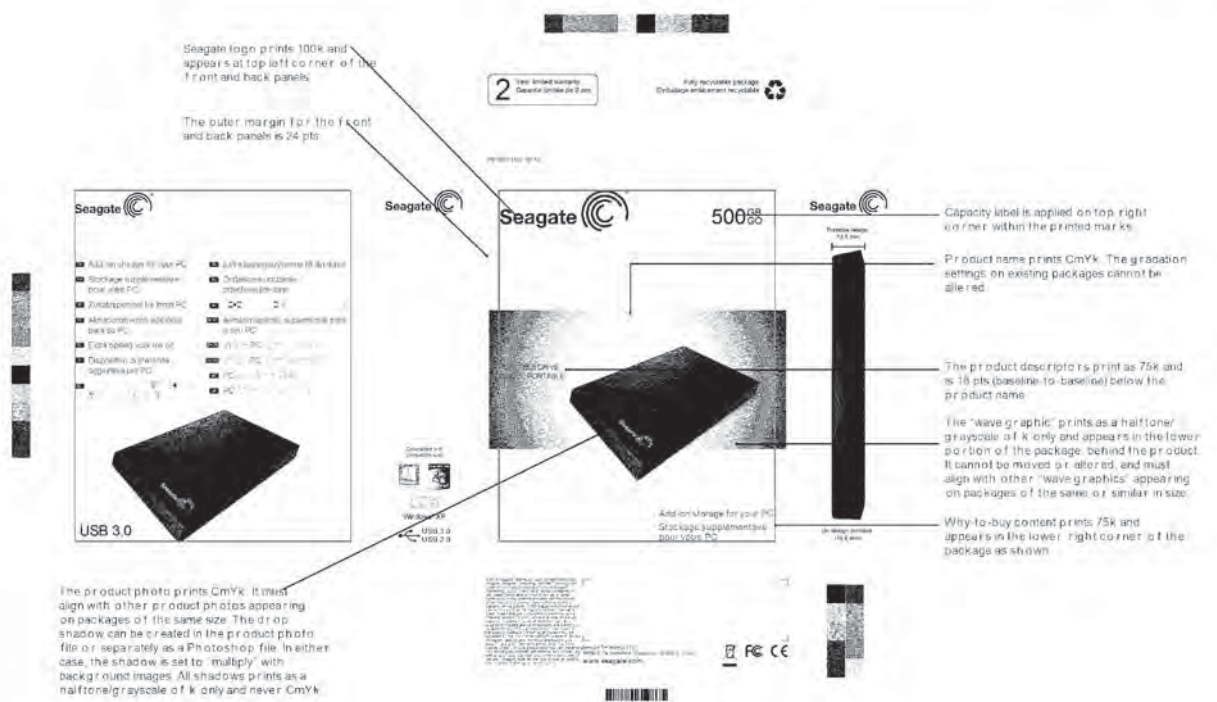
PACKAGE LINE UP AND ALIGNMENTS



STRUCTURE OVERVIEW



EXPANSION PACKAGE front of Box



EXPANSION PACKAGE BACK of BOX

The outer margin for the front and back panels is 24 pts

Seagate logo prints 100k and appears at the top left corner of the front and back panels

Content for back of box is specific to each product layout may vary based on actual content.

Color density strip appears centered on the side flap as shown

Product photo prints CMYK. All shadows prints as a halftone/ grayscale 61 k only and never CMYK.



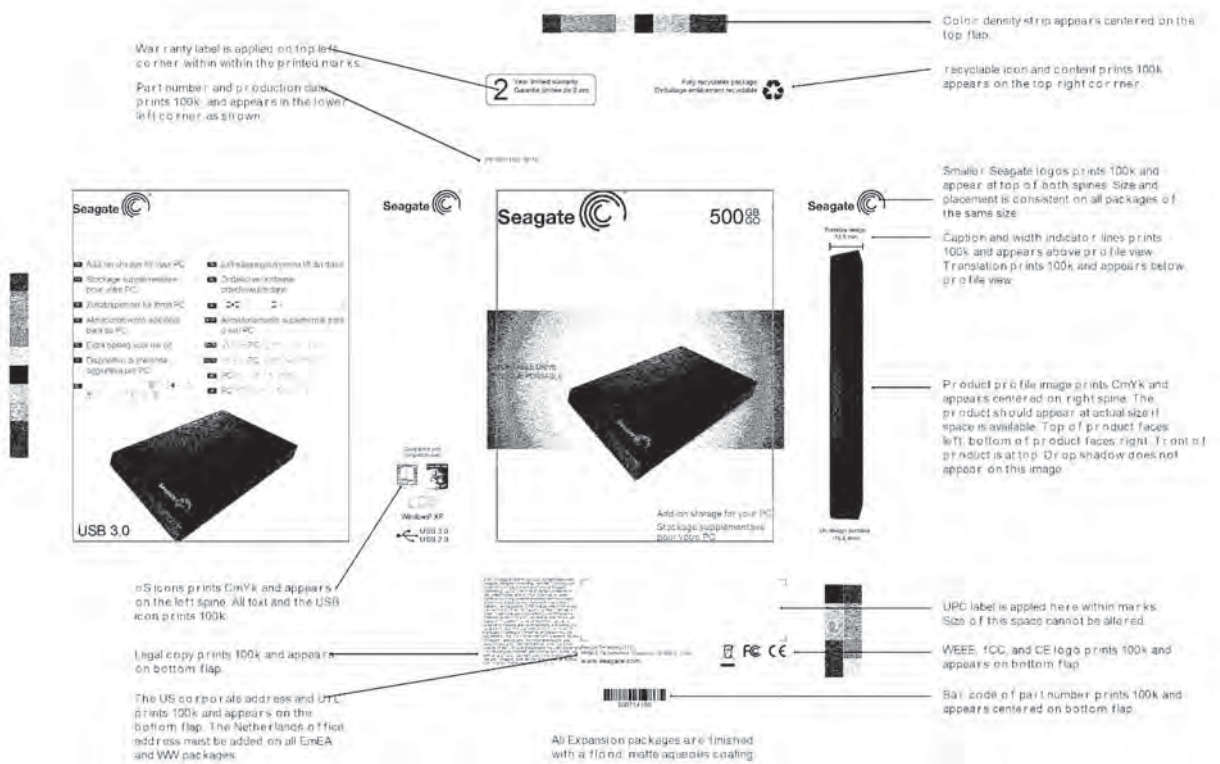
2

Two limited warranty
Garantie limitée de 2 ans

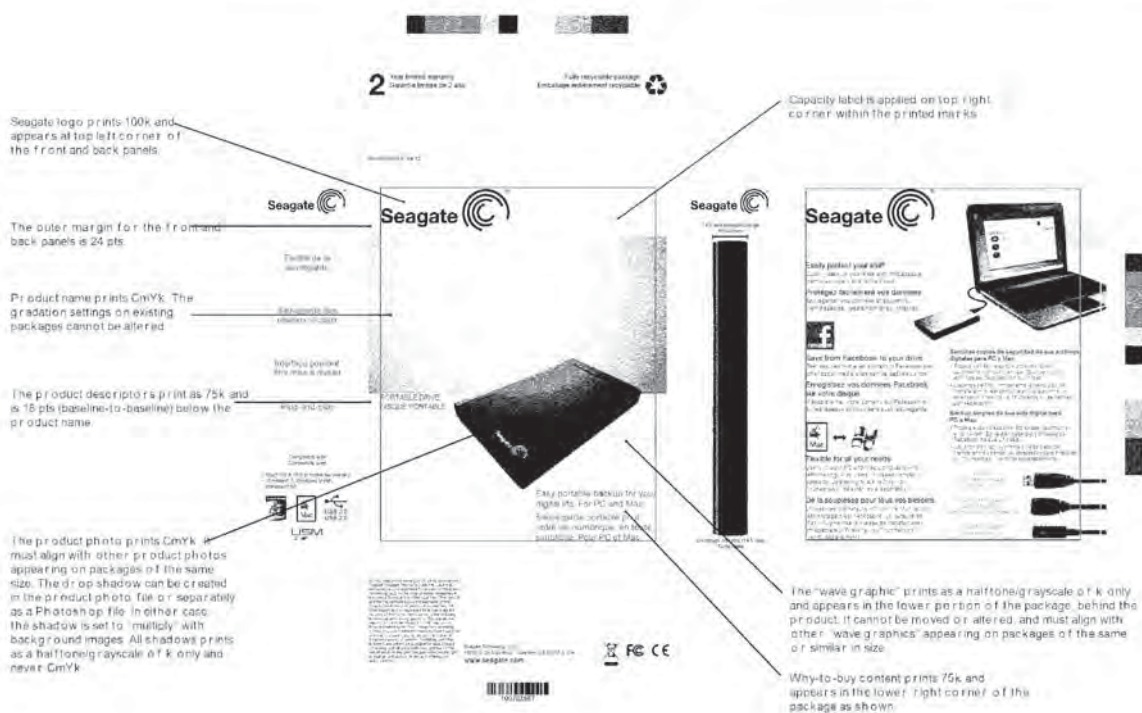
Recycle this package
Cyclable emballage recyclable



EXPANSION PACKAGE, SPINE AND FLAPS



BACKUP PLUS PACKAGE: FRONT of Box



BACKUP PLUS PACKAGE: SPINES AND FLAPS

Warranty prints 100k and appears on the top left corner.

Part number and production date prints 100k and appears in the lower left corner.

2

Two limited warranty periods are listed on 2 and 3.

Full recyclable package Enclosure not for reuse recyclable

Color density strip appears centered on the top flap.

recyclable icon and content prints 100k appears on the top right corner.

Smaller Seagate logos prints 100k and appear at top of both spines. Size and placement is consistent on all packages of the same size.

Product features appear on left spine. The English prints as a linear CMYK gradient using the same colors as the product name on the front panel. French translations print in /5k.

OS icons prints CMYK and appears on the left spine. All text and the USB icon prints 100k.

Legal copy prints 100k and appears on bottom flap.

The US corporate address and UPC prints 100k and appears on the bottom flap. The Netherlands office address must be added on all EMEA and WW packages.



Caption and width indicator lines prints 100k and appears above product view. Translation prints 100k and appears below product view.

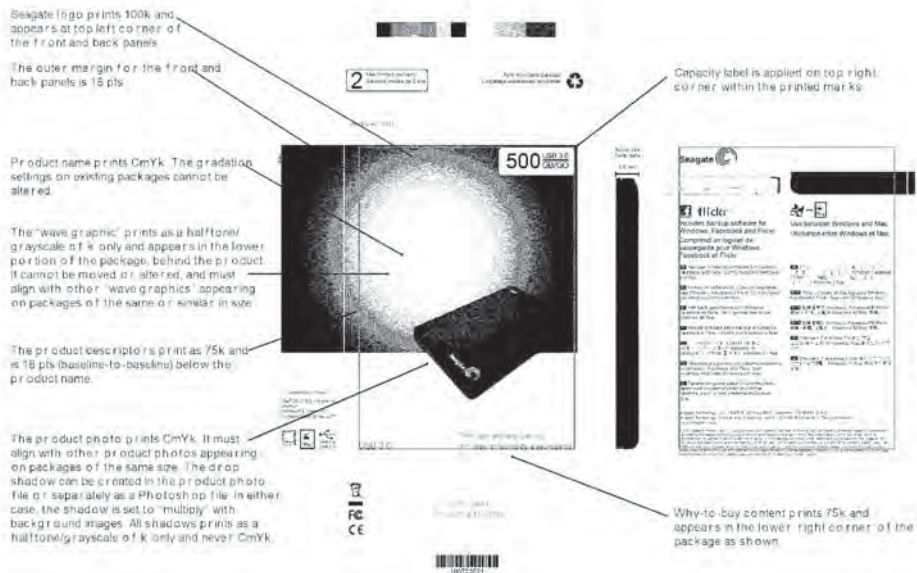
Product profile image prints CMYK and appears centered on right spine. The product should appear at actual size if space is available. Top of product faces left bottom of product faces right. Front of product is at top. Drop shadow does not appear on this image.

UPC label is applied here within marks. Size of this space cannot be altered.

WEEE, FCC, and CE logo prints 100k and appears on bottom flap.

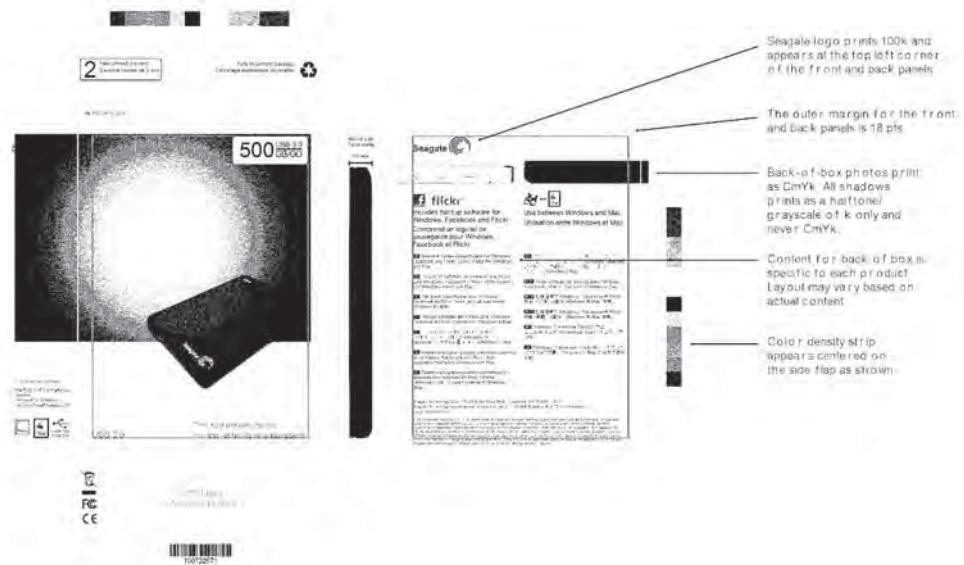
Bar code of part number prints 100k and appears centered on bottom flap.

SLIM PACKAGE FRONT of BoX

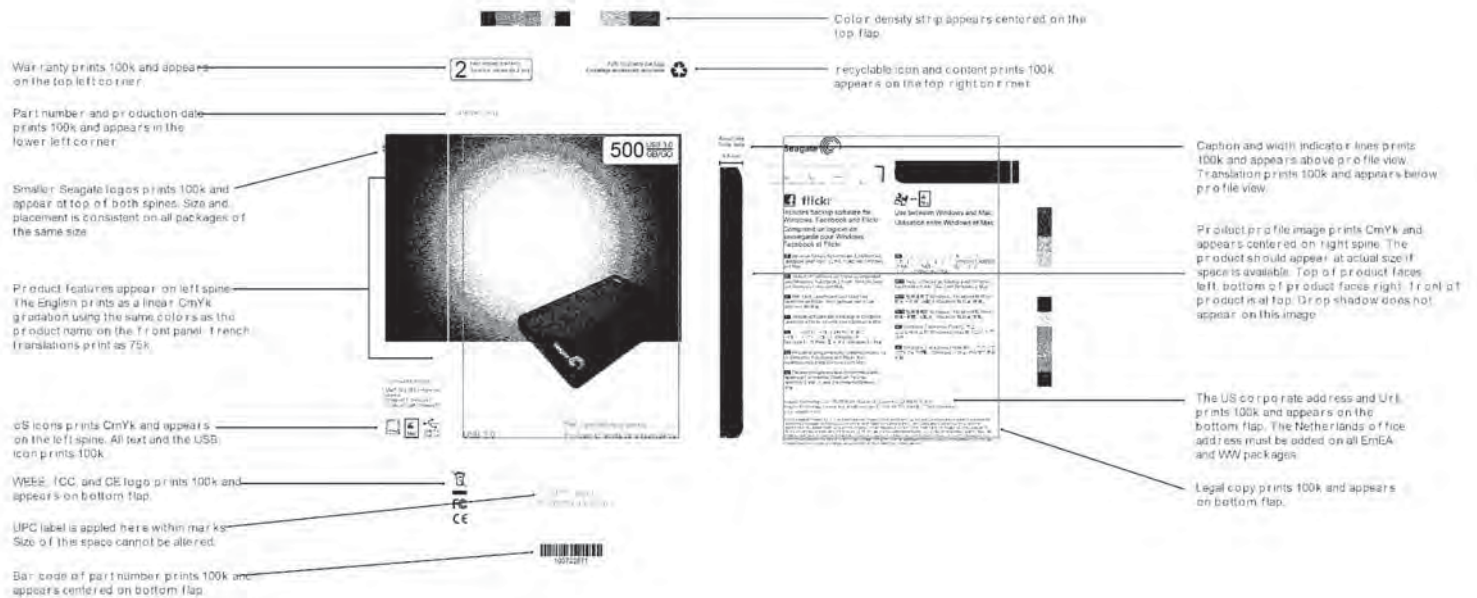


CONFIDENTIAL

Slim PACKAGE BACK of Box



SLIM PACKAGE, SPINES AND FLAPS



CAPACITY LABEL GUIDELINES



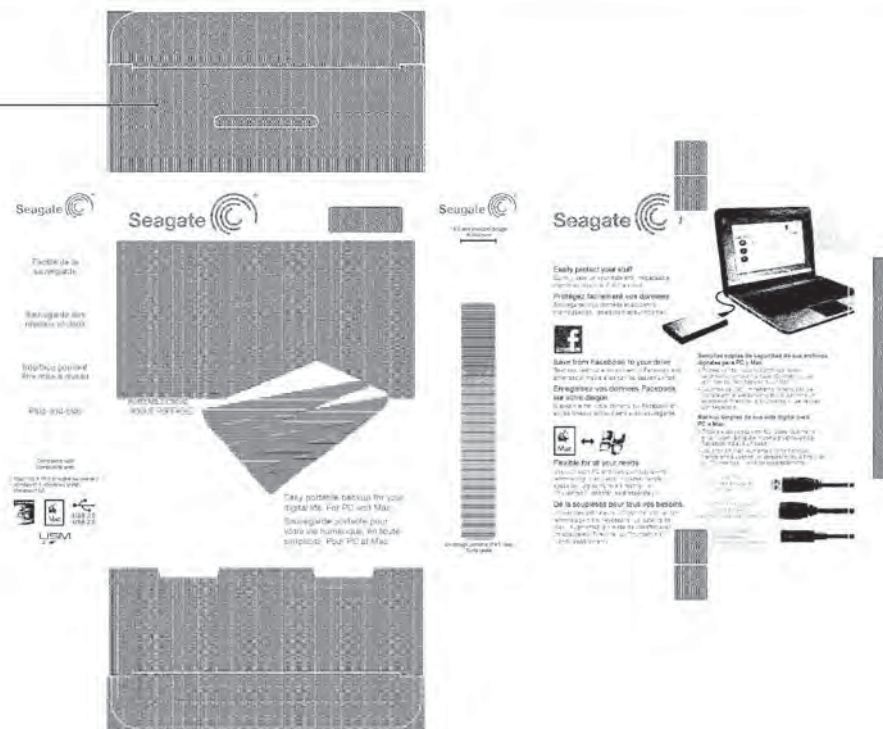
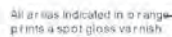
The capacity label is applied at the top right corner and cannot be moved.

The size of this capacity label is 1.25" x 0.45" with 0.05" rounded corners. The size is consistent for all packages of the same size.

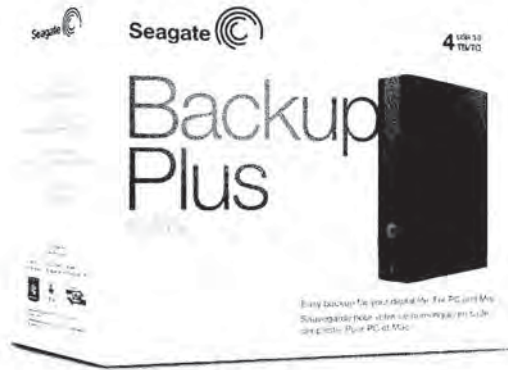
The label prints one-color (k) with gloss PP coating on white label stock. Background bleeds and prints 20% tint of k. Type and rule prints 100% k.

Position marks are printed on the package to assist with fulfillment.

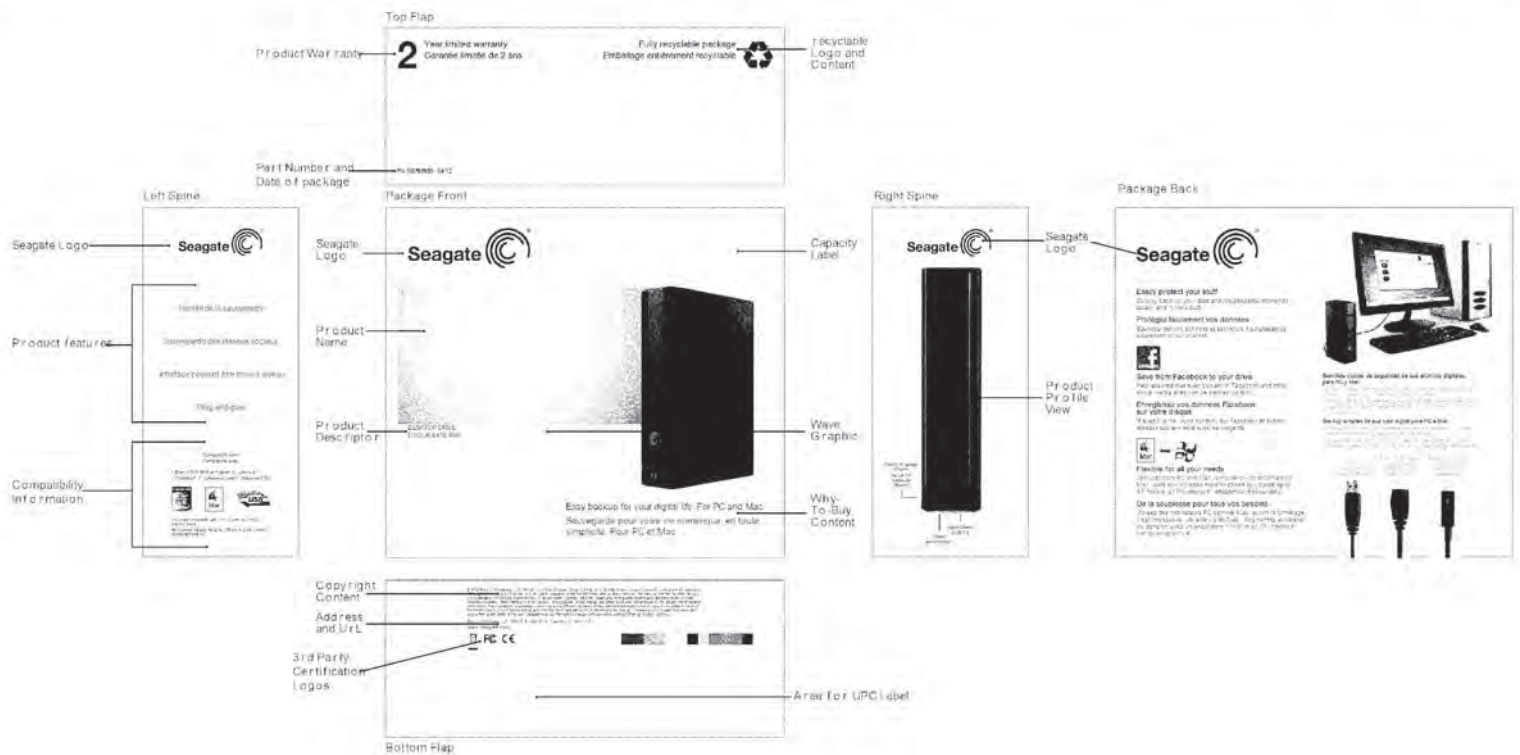
VARNISH TREATMENT GUIDELINES



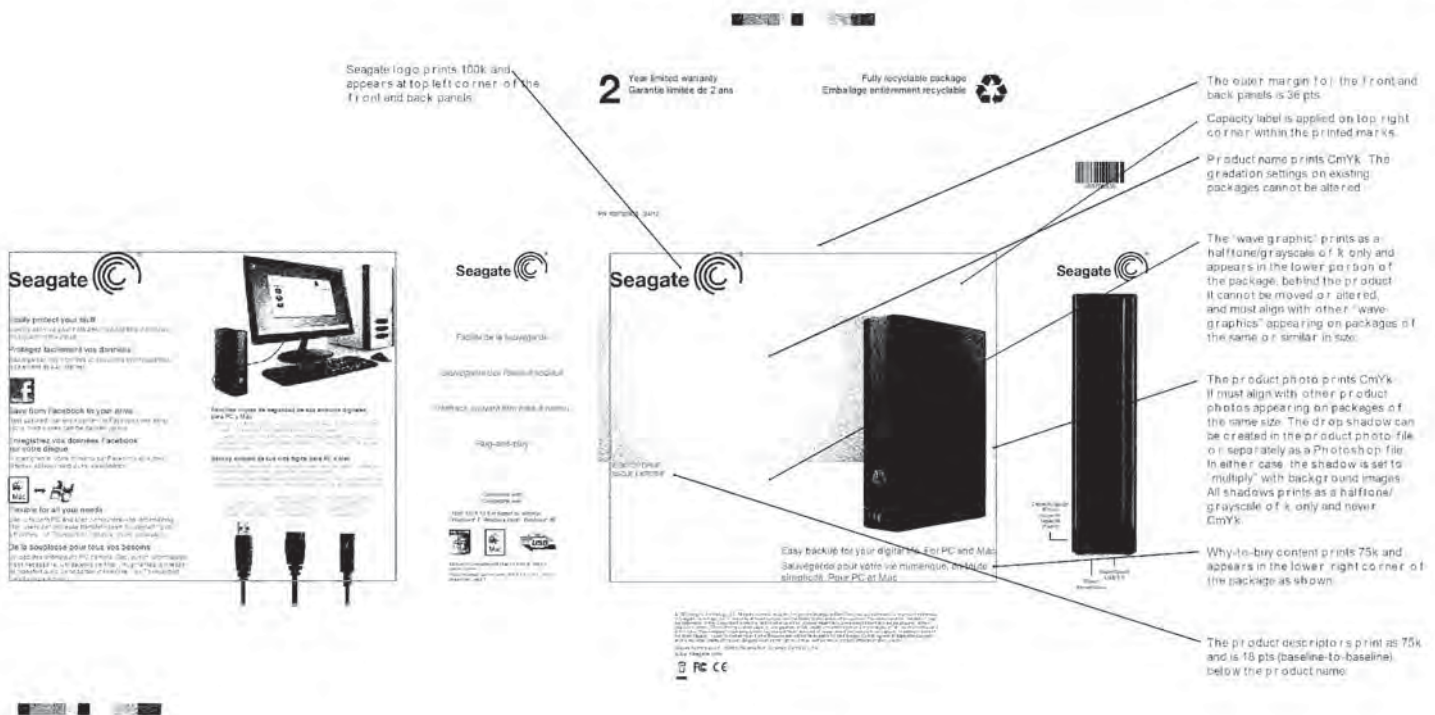
WIRELESS PACKAGING OVERVIEW



STRUCTURE OVERVIEW



BACKUP PLUS DESK PACKAGE, Front of Box



BACKUP PLUS DESK PACKAGE BACK of Box



2

Year limited warranty
Garantie limitée de 2 ansFully recyclable package
Emballage entièrement recyclable

PL 40209401-0412

Seagate logo prints 100k and appears at the top left corner of the front and back panels.

Back-of-box photo prints CMYK. All shadows prints as a halftone/grayscale of k only and never CMYK.

Content for back of box specific to each product. Layout may vary based on actual content.

The outer margin for the front and back panels is 36 pts.



Pack de la sauvegarde

Sauvegardez tout, partout, toujours.

Tout ce que vous avez en tête, nous le sauvegarçons.

Plug-and-play

Compatible avec

Windows 7, Windows 8, Windows 10

Mac OS X 10.6.8 ou supérieur

Linux (Ubuntu 12.04 LTS ou supérieur)

Seagate Backup Plus Desktop Package

Modèle: ST4000LX008

Capacité: 4 To

Vitesse de rotation: 5400 RPM

Format: 3.5"

Poids: 1.5 kg

Dimensions: 128 x 128 x 128 mm

Garantie: 2 ans

Écologie: emballage recyclable

Certification: RoHS

Certification: CE

Certification: FCC

Certification: BSMI

Certification: CCC

Certification: KC

Certification: CB

Certification: ENEC

Certification: TSE

Certification: UKCA

Certification: UKCA

Certification: UKCA

Certification: UKCA

Certification: UKCA

Certification: UKCA

Certification: UKCA

Certification: UKCA

Certification: UKCA

Certification: UKCA

Certification: UKCA

Certification: UKCA

Certification: UKCA

Certification: UKCA

Certification: UKCA

Certification: UKCA

Certification: UKCA

Certification: UKCA

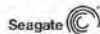
Certification: UKCA

Certification: UKCA

Certification: UKCA

Certification: UKCA

Certification: UKCA



Pack de la sauvegarde

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Seagate Backup Plus Desktop Package

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Poids: 1.5 kg

Dimensions: 128 x 128 x 128 mm

Garantie: 2 ans

Écologie: emballage recyclable

Certification: RoHS

Certification: CE

Certification: FCC

Certification: BSMI

Certification: CCC

Certification: KC

Certification: CB

Certification: ENEC

Certification: TSE

Certification: UKCA

Certification: UKCA

Certification: UKCA

Certification: UKCA

Certification: UKCA

Certification: UKCA

Certification: UKCA

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Certification: UKCA

Certification: UKCA

Certification: UKCA

Certification: UKCA

Certification: UKCA

Certification: UKCA

Certification: UKCA

Certification: UKCA

Certification: UKCA

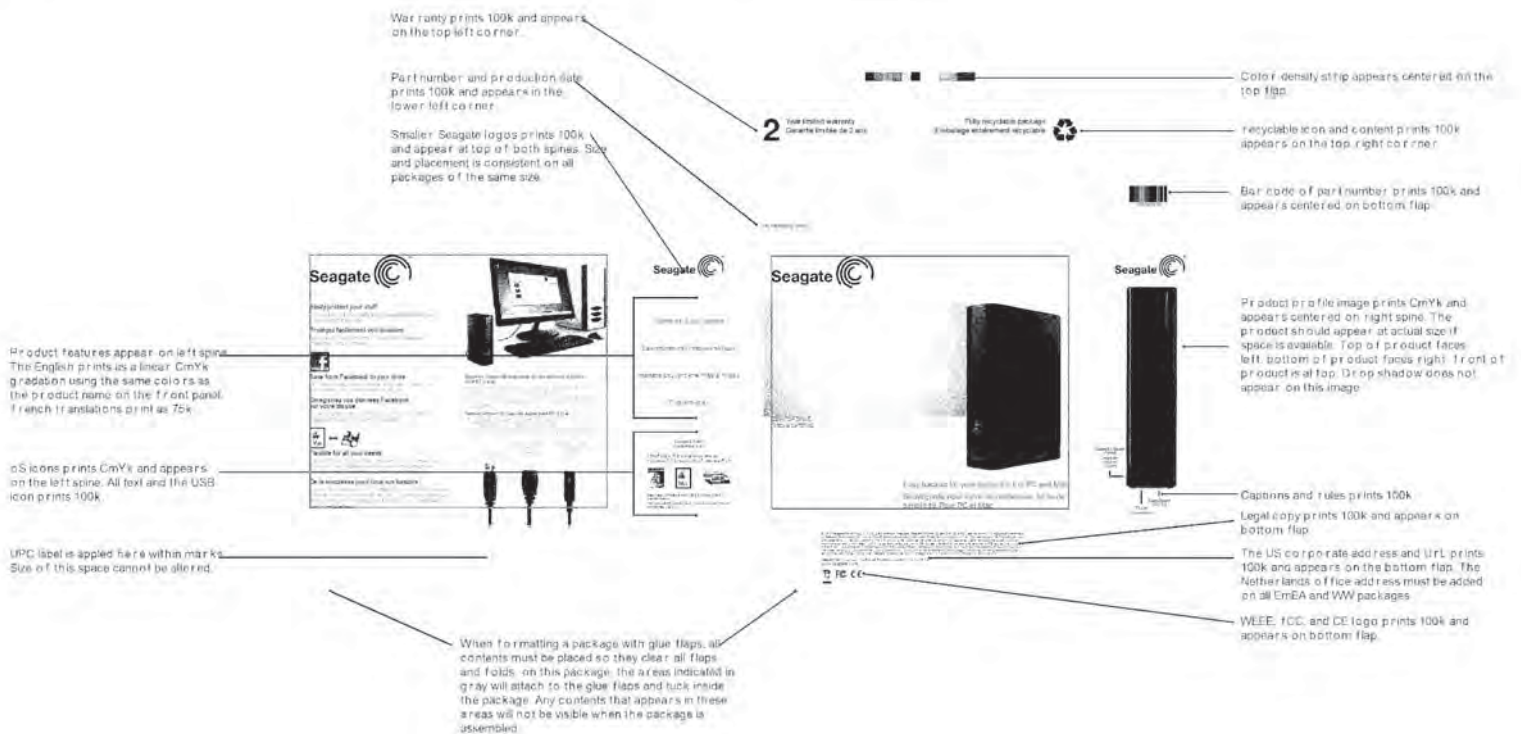
Certification: UKCA

Certification: UKCA

Certification: UKCA

Certification: UKCA

BACKUP PLUS DESK PACKAGE SPINES AND FLAPS



BACKUP PLUS DESK PACKAGE: CAPACITY LABEL



4 TB

The capacity label is applied at the top right corner and cannot be moved.

The size of this capacity label is 1.6" x 0.60" with 0.05" rounded corners. The size is consistent for all packages of similar size.

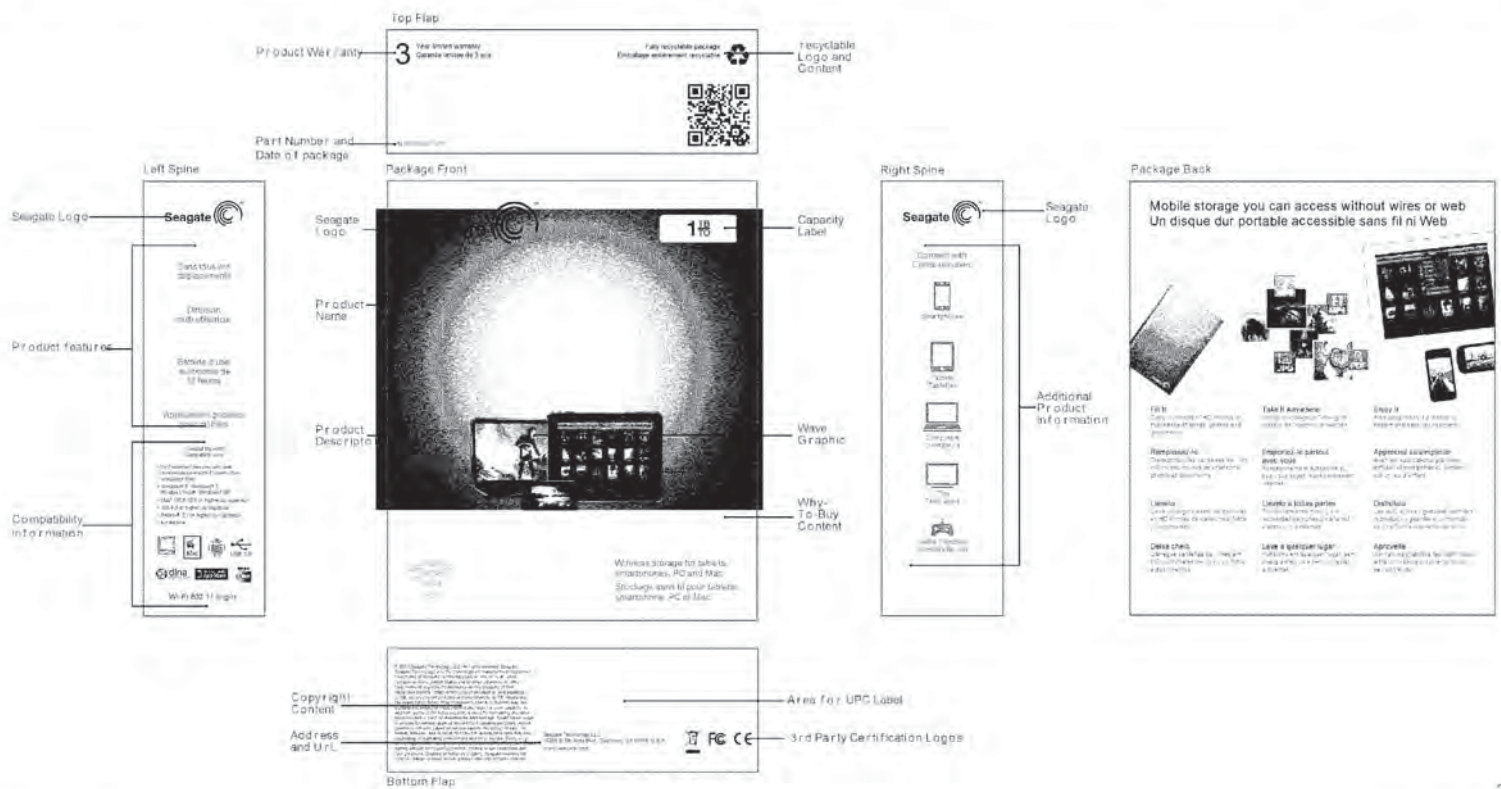
The label prints one-color (k) with gloss PP coating on white label stock. Background bleeds and prints 20% tint of k. Type and rule prints 100% k.

Position marks are printed on the package to assist with fulfillment.

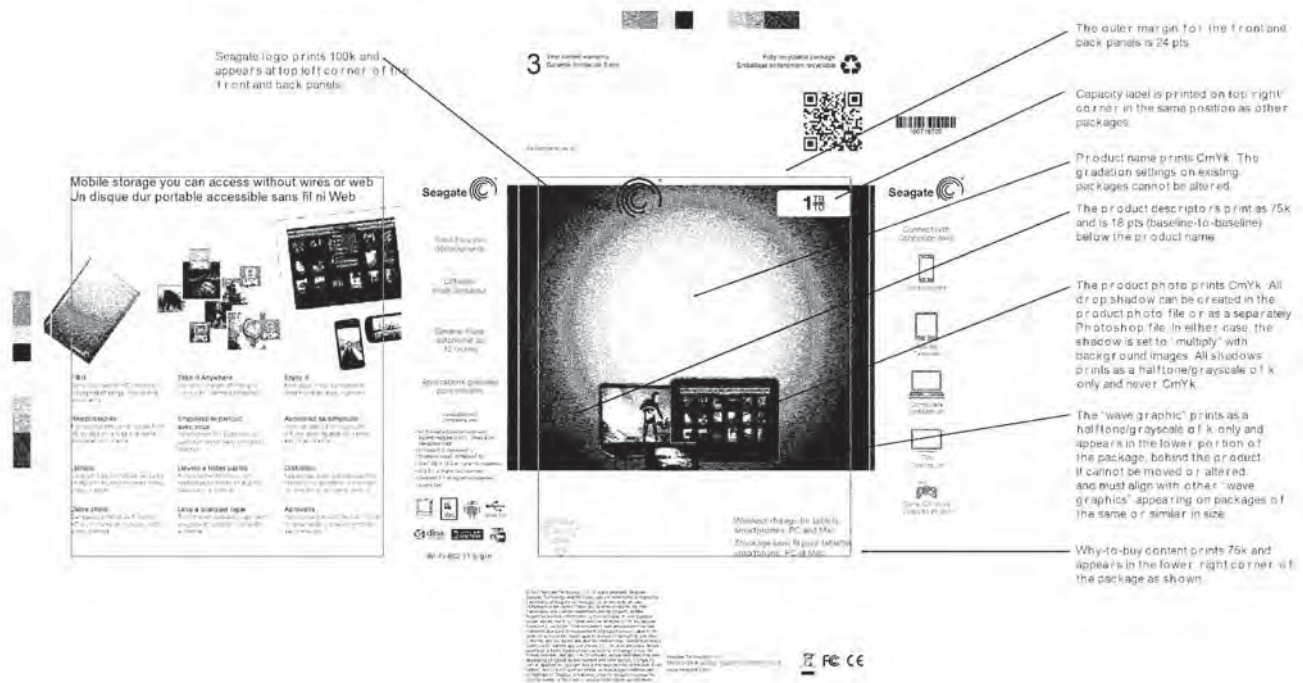
WIRELESS PLUS PACKAGING OVERVIEW



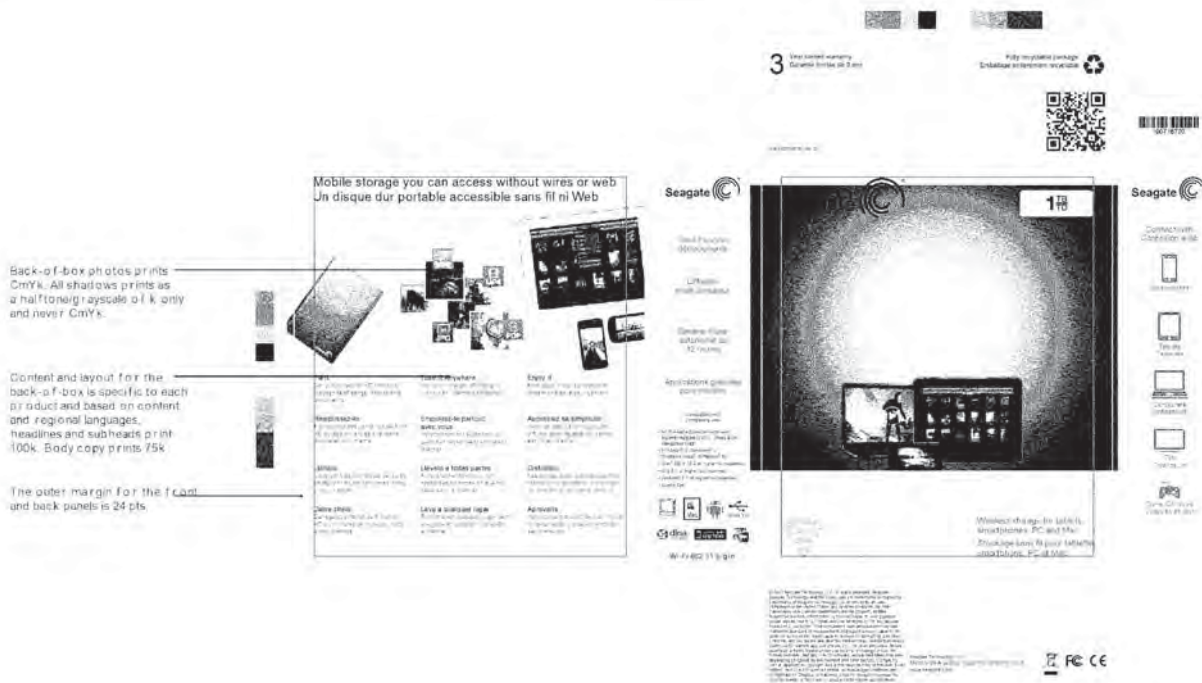
STRUCTURE OVERVIEW



WIRELESS PLUS PACKAGE FRONT of BOX



WIRELESS PLUS PACKAGE. BACK of BOX



WIRELESS PLUS PACKAGE, SPINES AND FLAPS

Was only prints 100k and appears
on the top left corner

Part number and pi production date
prints 100k and appears in the
lower left corner

Product features appear on left spine — The English prints as a linear, CMYK gradation using the same colors as the product name on the front panel. French translations print as 75k.

Compatibility content appears on left spine and prints 100x

oS and certification icons prints
CmYk and appears on the left spine.
Black icons print 100k only

Legal copy prints 100k and appears on bottom flap.

The US corporate address and UH prints 100k and appears on the bottom flap. The Netherlands office address must be added on all EmEA and WW packages.

3 Vsegi koristni vzgledy
Dobrota in milost, po 2 x

Full implantation package
Unlabeled reference material

- Color density strip appears centered on the top flap.

recyclable icon and content prints took
appears on the top right corner.

- QR code prints 100k and appears on lower right corner of the top flap.

- Bar code of part number prints 100k and appears centered on bottom flap

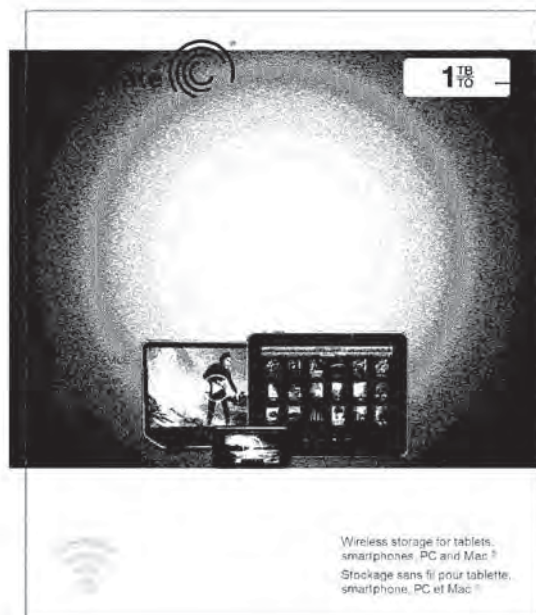
- Smaller Seagate logos prints 100% and appear at the top of both spines. Size and placement is consistent on all packages of the same spine width.

- icons for this package print as 100C, 20m. Text and captions print 75k.

UPC label is applied here within marks.
Size of this space cannot be altered.

- WEEE, FCC, and CE logo prints 100k and appears on bottom flap

WIRELESS PLUS PACKAGE, CAPACITY LABEL



1TB
10

The capacity label is applied at the top right corner and cannot be moved.

The size of this capacity label is 1.25" x 0.45" with 0.05" rounded corners. The size is consistent for all packages of the same size.

The label prints one-color (k) with gloss PP coating on white label stock. Background bleeds and prints 20% tint of k. Type and rule prints 100% k.

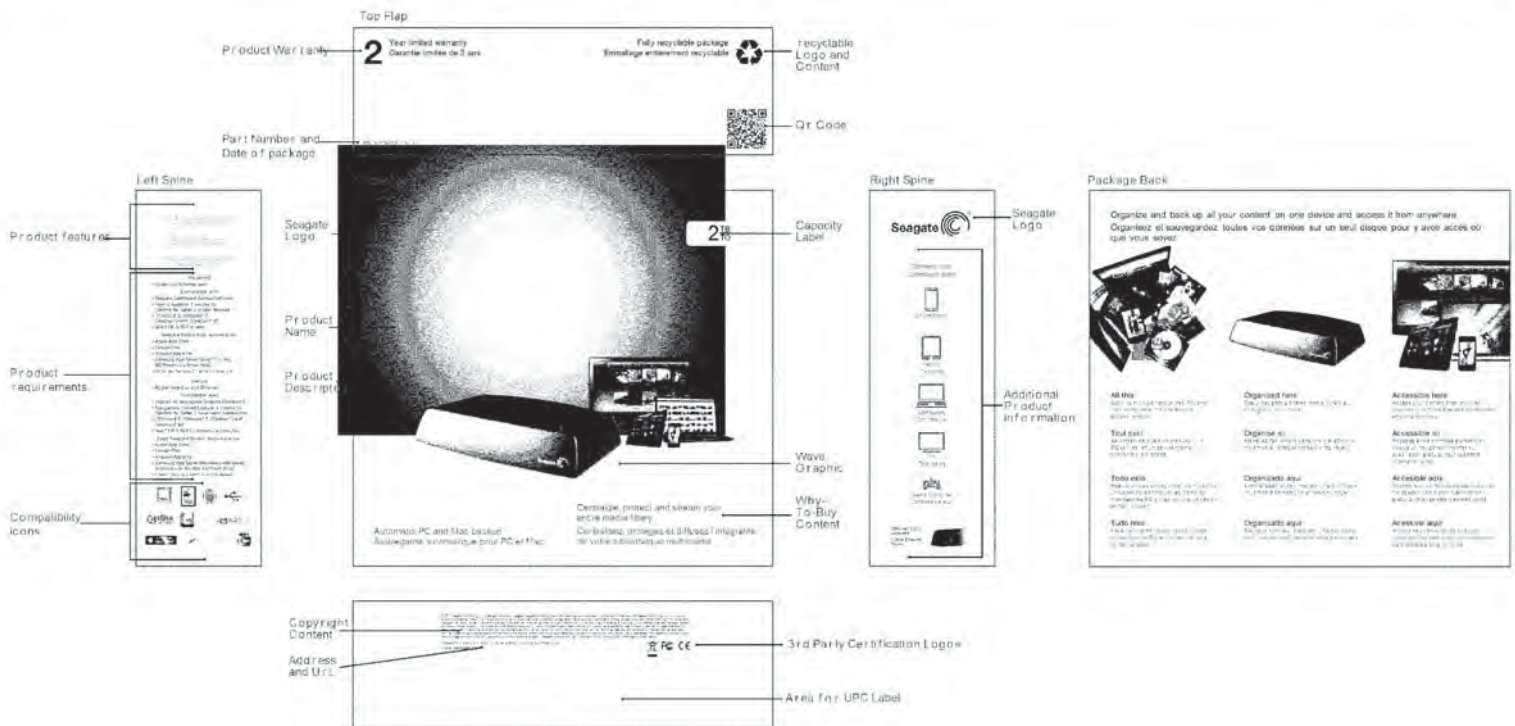
Position marks are printed on the package to assist with fulfillment.

Wireless storage for tablets, smartphones, PC and Mac.
Stockage sans fil pour tablette, smartphone, PC et Mac.

CENTRAL PACKAGING OVERVIEW



STRUCTURE REVIEW



CENTRAL PACKAGE FRONT of Box1

The outer margin for the front and back panels is 36 pts.

Product name prints CMYK. The gradient settings on existing packages cannot be altered.

The product description prints as 75k and is 26 pts (baseline-to-baseline) below the product name.

The product photo prints CMYK. All drop shadow can be created in the product photo file or as a separately Photoshop file. In either case, the shadow is set to "multiply" with background images. All shadows print as a halftone/grayscale of 8 only and never CMYK.

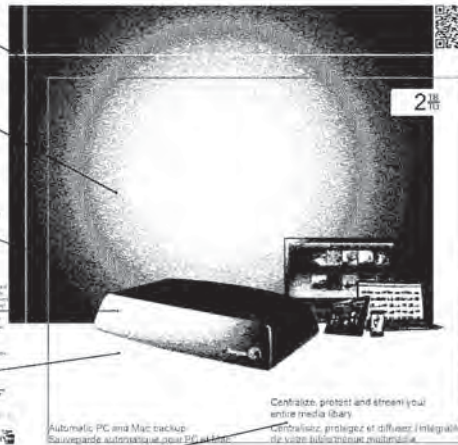
The "wave graphic" prints as a halftone/grayscale of 8 only and appears in the lower portion of the package behind the product. It cannot be moved or altered, and must align with other "wave graphics" appearing on packages of the same or similar in size.

Why-to-buy content prints 75k and appears in the lower right corner of the package as shown.

2

Year limited warranty
Garantie limitée de 2 ans

Fully recyclable package
Emballage entièrement recyclable



Seagate



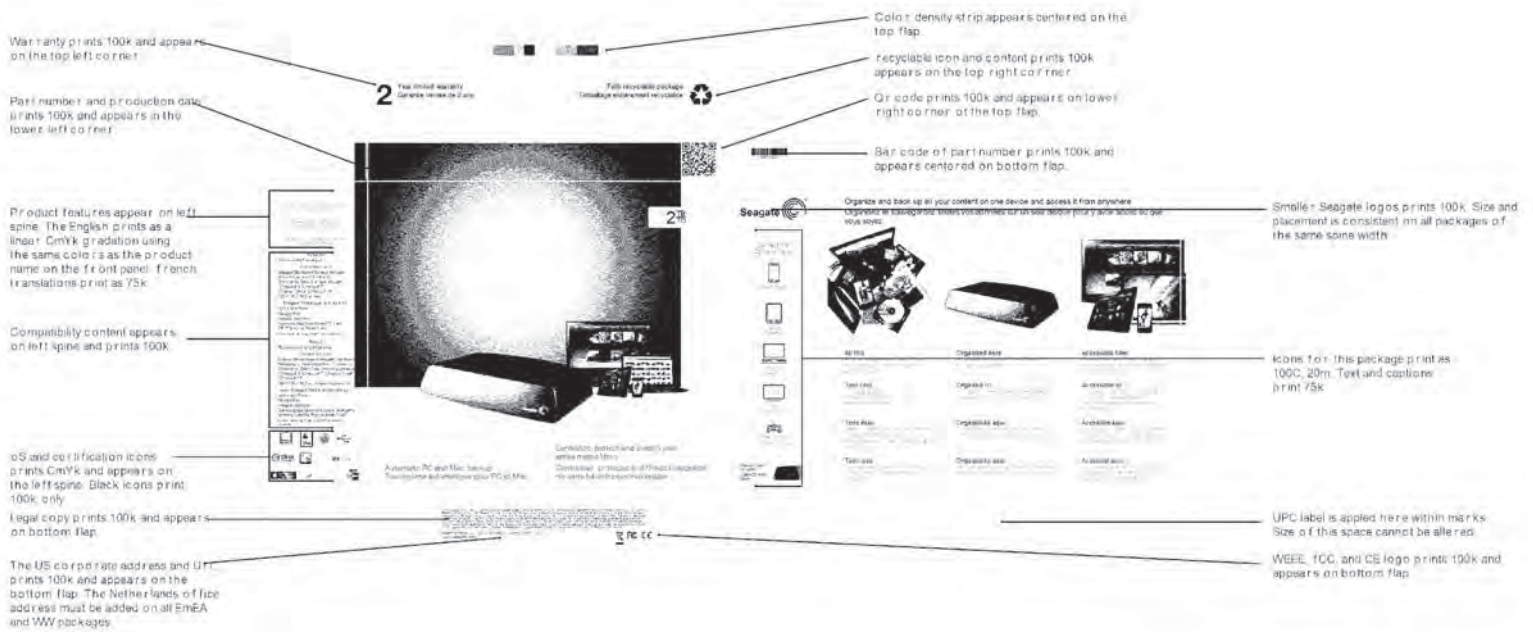
Capacity label is applied on top right corner within the printed marks.



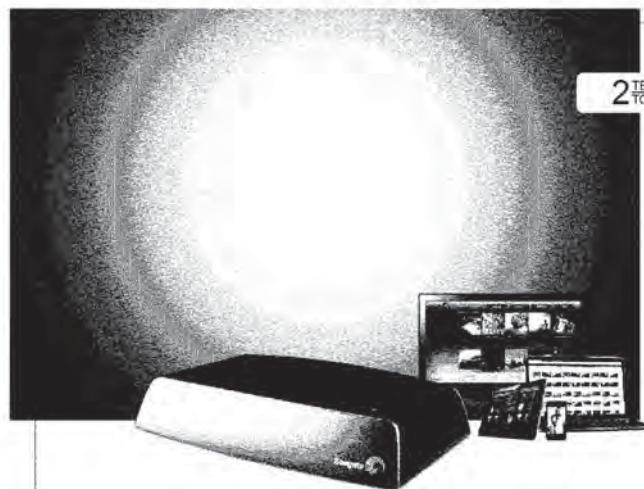
CENTRAL PACKAGE BACK of BOX



CENTRAL PACKAGE SPINES AND FLAPS



CENTRAL PACKAGE CAPACITY LABEL



2TB
TO

The capacity label is applied at the top right corner and cannot be moved.

The size of this capacity label is 1.25" x 0.45" with 0.05" rounded corners. The size is consistent for all packages of the same size.

The label prints one-color (k) with gloss PP coating on white label stock. Background bleeds and prints 20% int o f k. Type and rule prints 100% k.

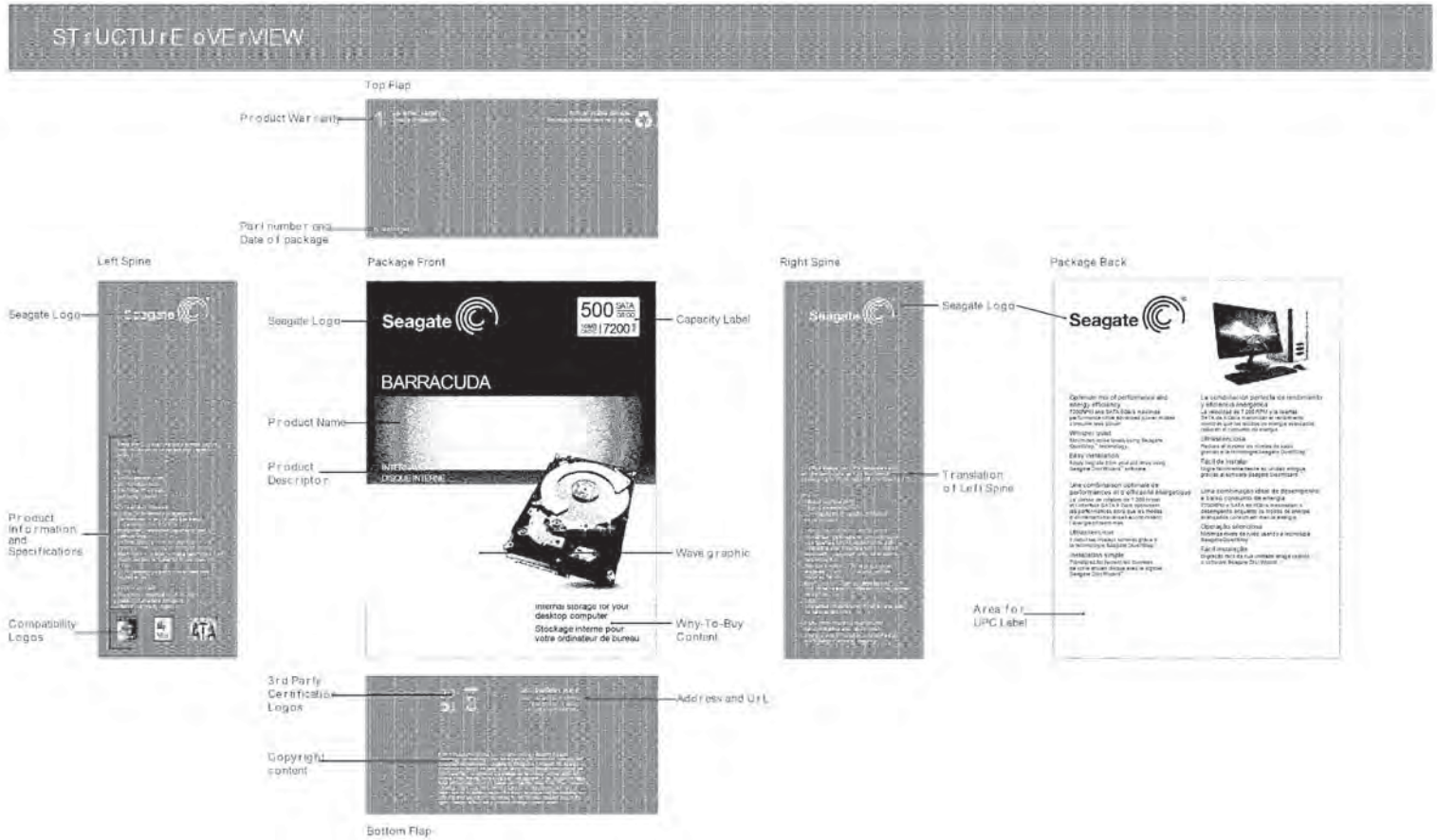
Position marks are printed on the package to assist with fulfillment.

Automatic PC and Mac backup
Sauvegarde automatique pour PC et Mac

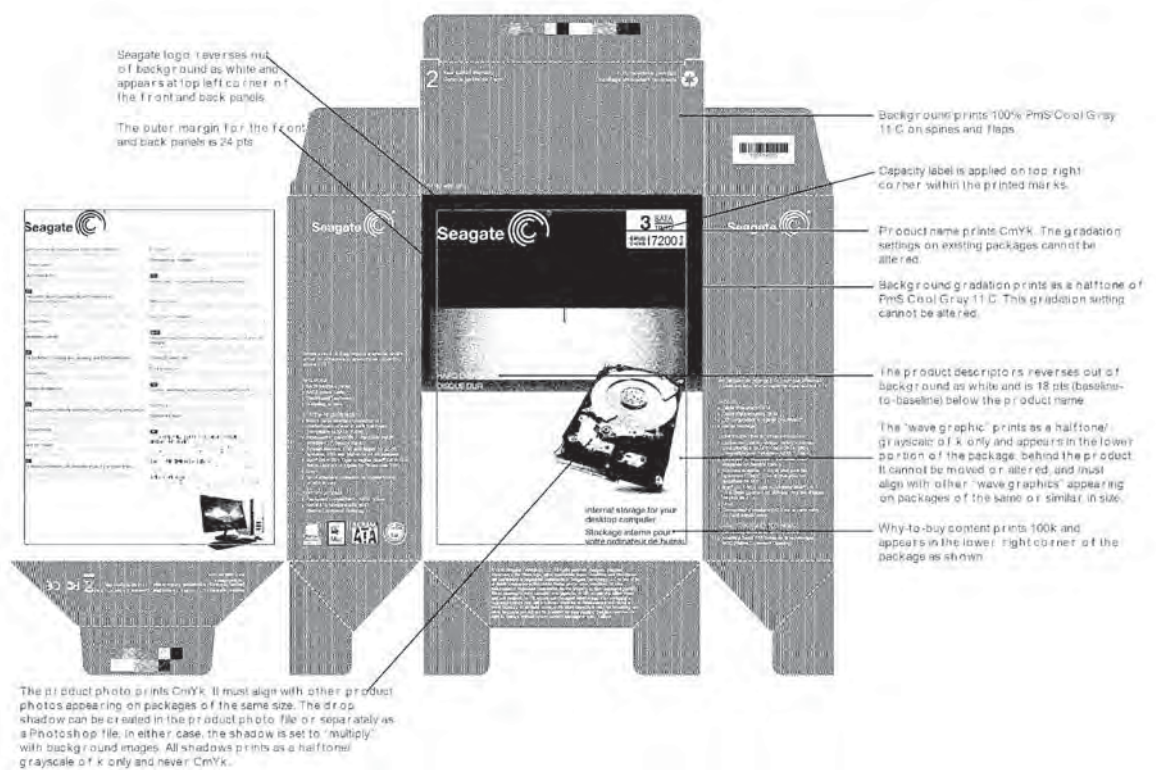
Centralize, protect and stream your
entire media library
Centralisez, protégez et diffusez l'intégralité
de votre bibliothèque multimédia

INTERNAL DRIVE PACKAGES





BARRACUDA DESKTOP PACKAGE: FRONT of BOX



BARRACUDA DESKTOP PACKAGE BACK of Box

The outer margin for the front and back panels is 24 pts

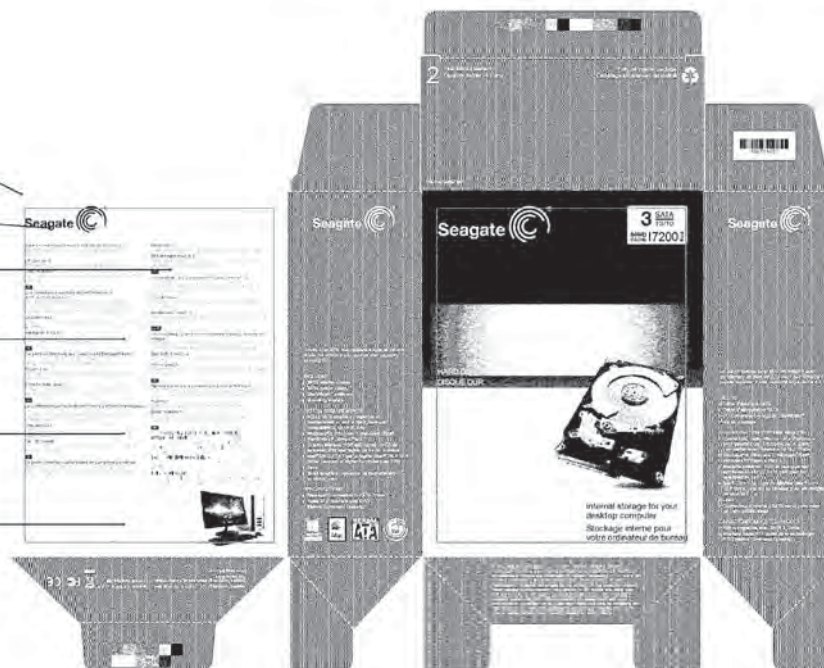
Seagate logo prints 100k and appears at the top left corner of the front and back panels

Back-of-box product photo prints CMYK. All shadows prints as a half-tone grayscale of K only and never CMYK

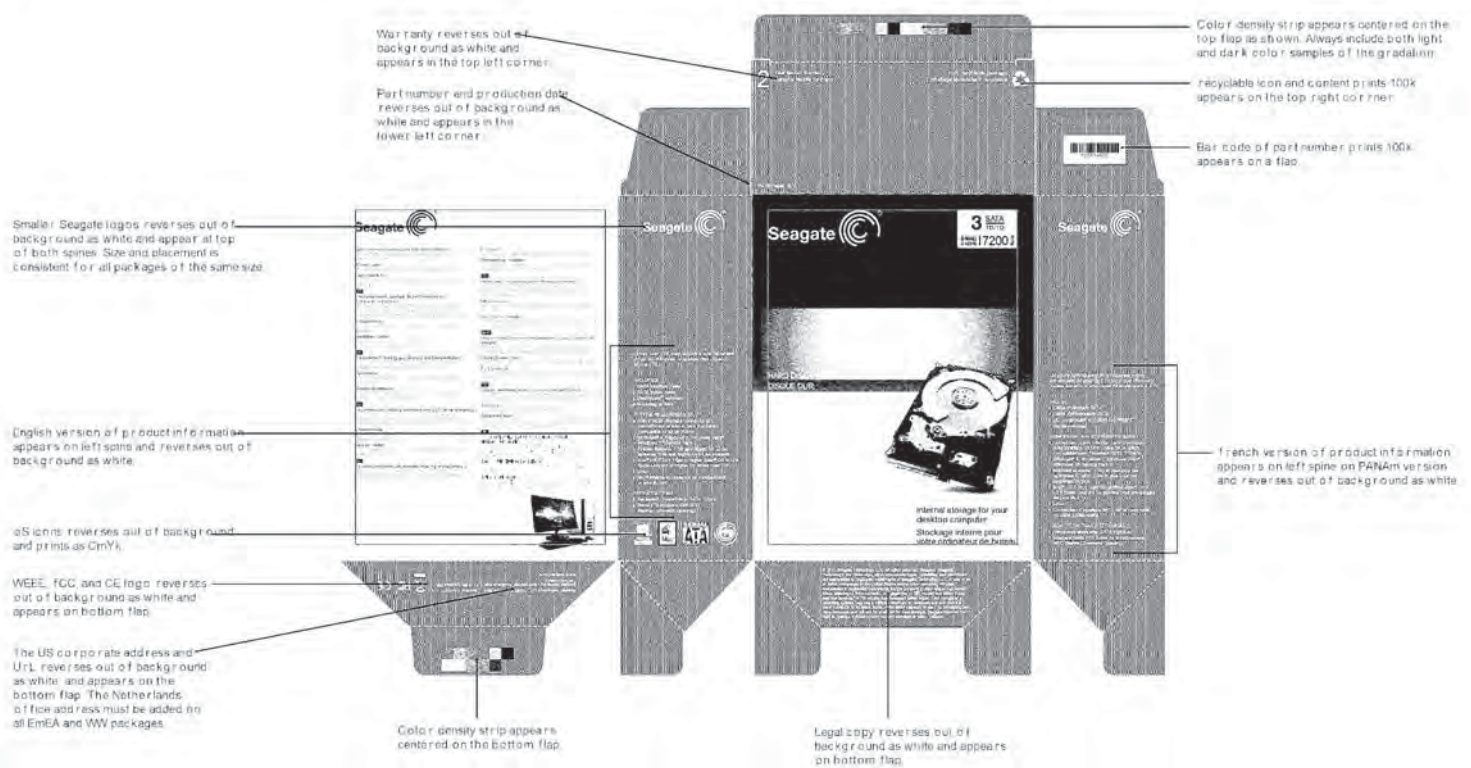
Content for back of boxes specific to each product. Layout may vary based on actual content.

Background of back of box prints as white

UPC label is applied here within marks. Size of this space cannot be altered



Barracuda DESKTOP PACKAGE SPINES AND FLAPS



momentUS AND BARRACUDA PACKAGE CAPACITY LABEL



Internal storage for
your laptop
Stockage interne pour
votre ordinateur portable



Internal storage for your
desktop computer
Stockage interne pour
votre ordinateur de bureau

The capacity label is applied at the top right corner and cannot be moved.

The size of this capacity label is 1.265" x 0.805" with 0.06" rounded corners. The design and size is consistent for all internal drive packages.

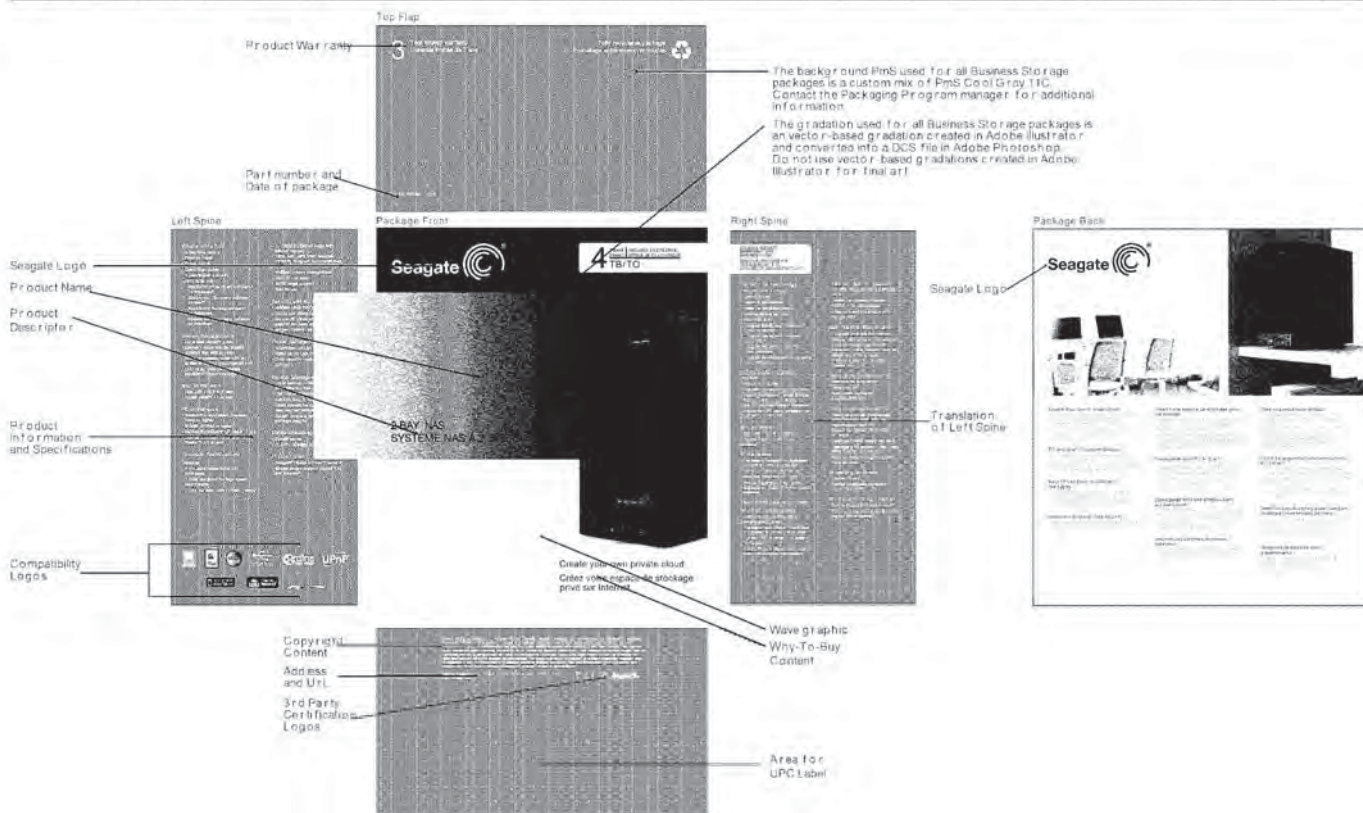
This label prints one-color (Black) with glossy PP coating on white label stock. Background prints 20% tint of Black. Type and rule prints 100% Black.

Position marks are printed on the package to assist with fulfillment.

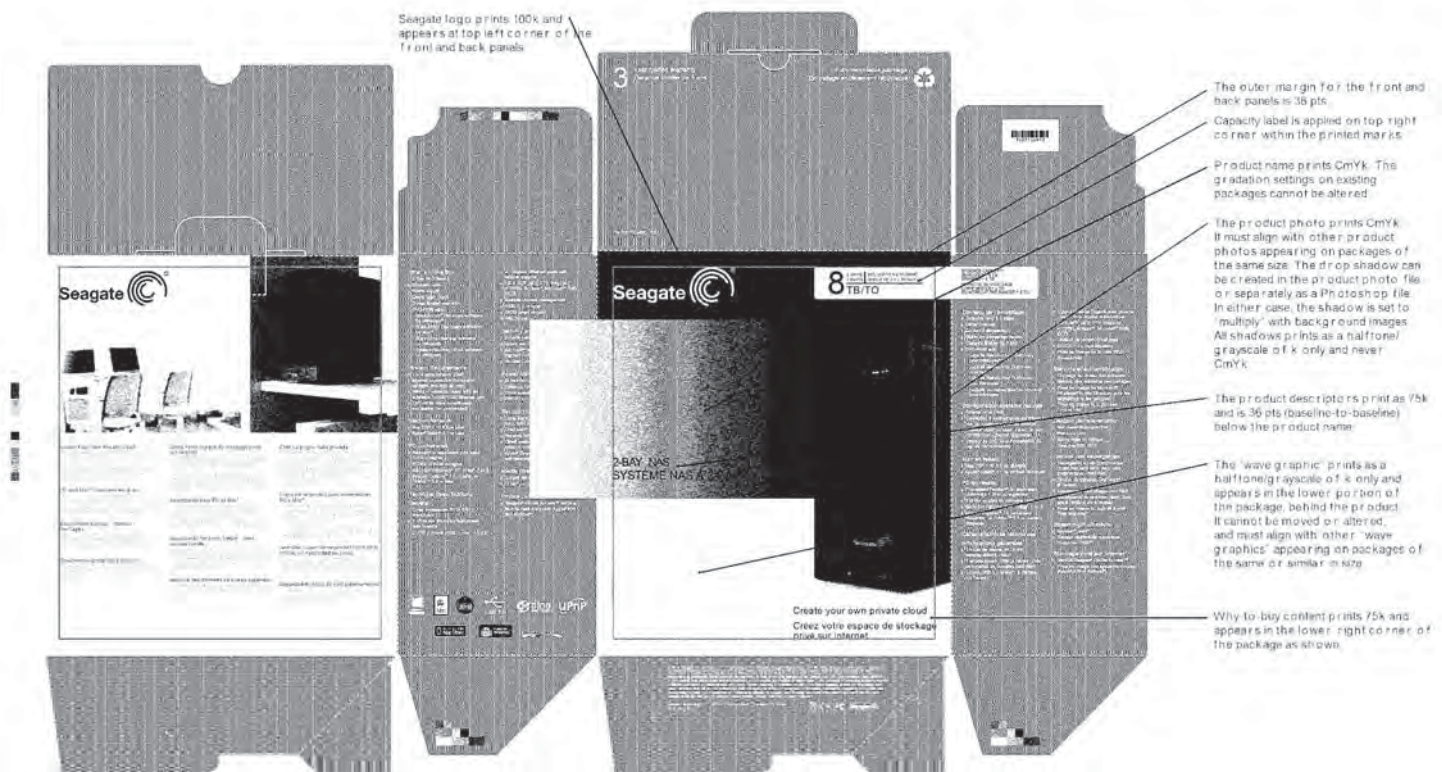
BUSINESS STORAGE PACKAGES



STRUCTURE REVIEW



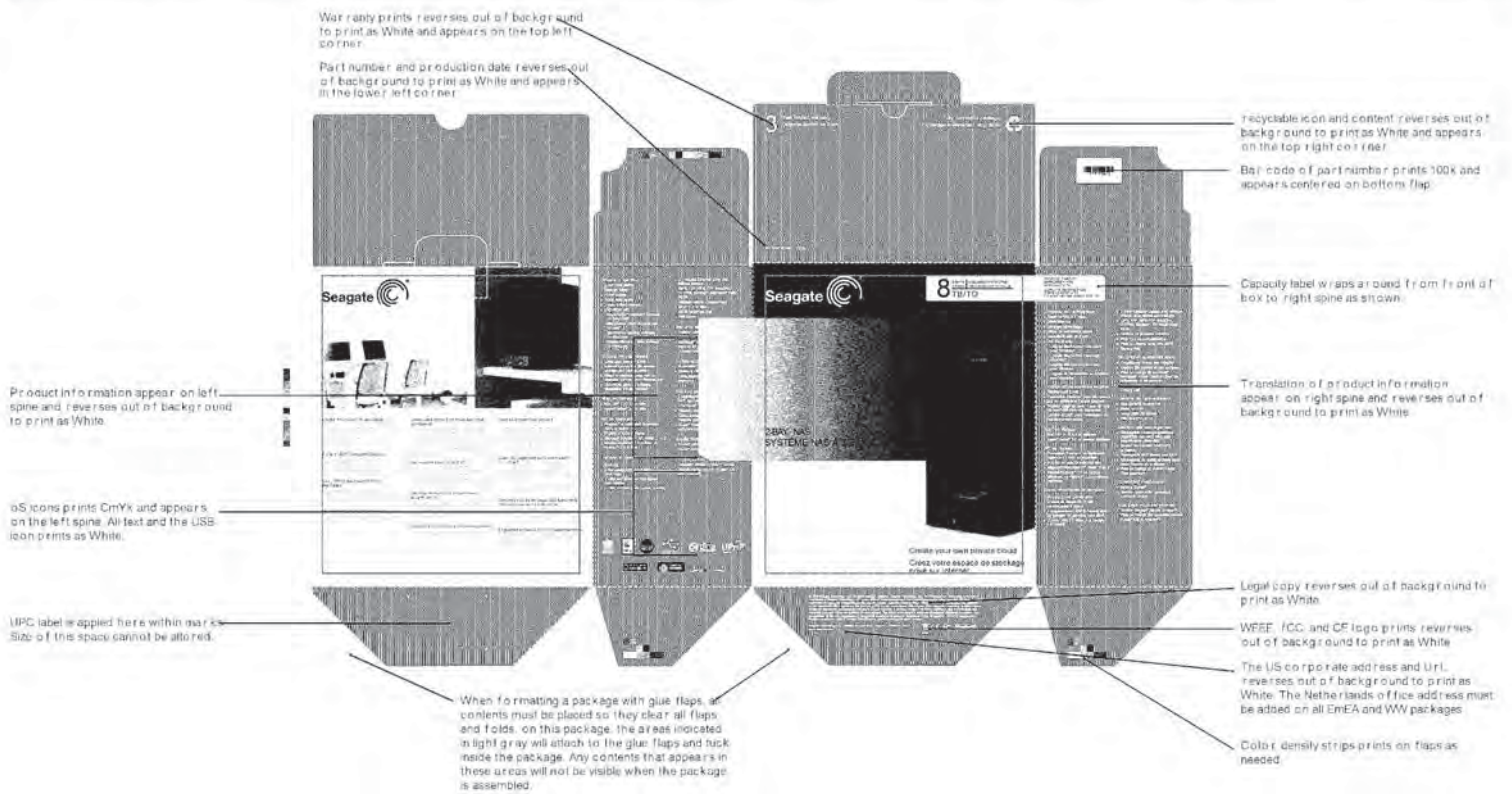
BUSINESS STORAGE PACKAGES: FRONT of Box



BUSINESS STORAGE PACKAGES: BACK of Box



BUSINESS STORAGE PACKAGES: SPINES AND FLAPS



BUSINESS STORAGE PACKAGES: CAPACITY LABELS



The capacity label is applied at the top, right corner and wraps onto the right spine. It cannot be moved.

The size of this capacity label is 173.0mm x 25.0mm with 2.0mm rounded corners. The size is consistent for all packages in this product line.

The label prints one-color (k) with gloss PP coating on white label stock. Background bleeds and prints 20% tint of k. Type and rule prints 100% k.

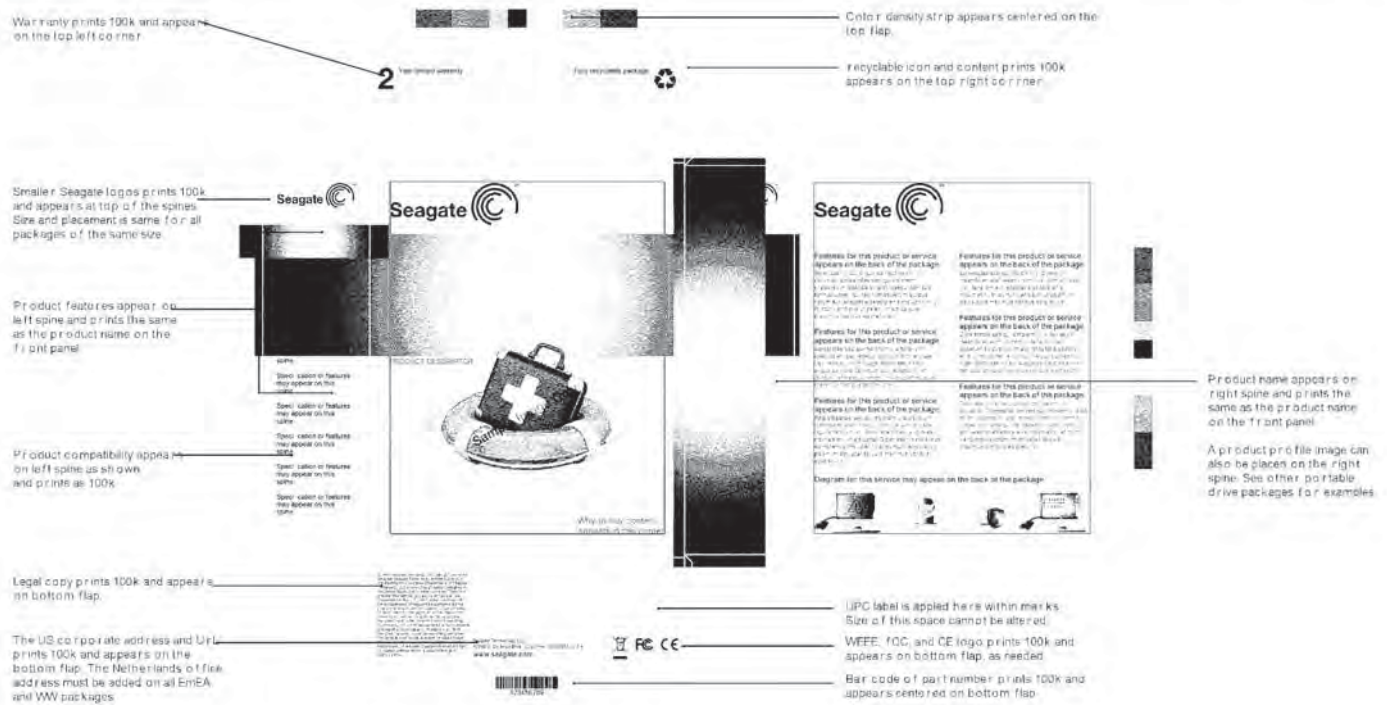
Position marks are printed on the package to assist with fulfillment.

GENERAL PACKAGE

2



GENERAL PACKAGE 1-LINE PRODUCT EXAMPLE SPINES AND FLAPS



GENERAL PACKAGE, 2-LINE PRODUCT NAME EXAMPLE: FRONT AND BACK PANELS



GENERAL PACKAGE, 2-LINE PRODUCT NAME EXAMPLE, SPINES AND FLAPS





Seagate Technology 10200 S. De Anza Blvd. Cupertino, CA 95014

CONFIDENTIAL

FED_SEAG0002557

EXHIBIT 10

UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA
SAN JOSE DIVISION

IN RE SEAGATE TECHNOLOGY LLC,)
LITIGATION)

NO. 5:16-cv-00523-RMW

DEPOSITION OF JEFFREY FOCHTMAN

Palo Alto, California

Friday, August 18, 2017

Reported By:

LINDA VACCAREZZA, RPR, CLR, CRP, CSR. NO. 10201

JOB NO. 210527

August 18, 2017

34 to 37

<p style="text-align: right;">Page 34</p> <p>1 are the primary audience. I think the primary</p> <p>2 audience is our reselling partner base.</p> <p>3 Q. So an end user or an end consumer could go</p> <p>4 out and find the storage solution guide on the</p> <p>5 Internet, for example, but they were not what you</p> <p>6 had mind when you created the guide?</p> <p>7 A. That's the way I look at it.</p> <p>8 Q. What's the global marketing team's</p> <p>9 involvement in creating these storage solution</p> <p>10 guides?</p> <p>11 A. We create them. So global marketing is in</p> <p>12 charge of assembling and compiling that information</p> <p>13 and putting it into a creative format.</p> <p>14 Q. And are there different storage solution</p> <p>15 guides by region?</p> <p>16 A. There have been. We have changed</p> <p>17 practices on how we have done that over time.</p> <p>18 MS. BEDE: Can you grab the documents</p> <p>19 behind Tab 5, please, and mark that as Exhibit 3.</p> <p>20 (Exhibit 3 was marked for identification.)</p> <p>21 THE WITNESS: All right.</p> <p>22 BY MS. BEDE:</p> <p>23 Q. Okay. What is this?</p> <p>24 A. This is a storage, Seagate Storage</p> <p>25 Solutions Guide from May 2012, with the region</p>	<p style="text-align: right;">Page 36</p> <p>1 I'll read. "Seagate external storage solutions are</p> <p>2 sleek, dependable and ultra portable products."</p> <p>3 That's the beginning of that paragraph there. Do</p> <p>4 you know how that language came about?</p> <p>5 A. I can't specifically recall how this</p> <p>6 paragraph came about. But the way it would come</p> <p>7 about in general is that our creative services</p> <p>8 writing department would have come up with it.</p> <p>9 Q. Where do they fall -- are they in the</p> <p>10 global marketing group?</p> <p>11 A. Yes, they are. Creative services is in</p> <p>12 global marketing.</p> <p>13 Q. Would you have had to approve this</p> <p>14 language?</p> <p>15 A. No.</p> <p>16 Q. Who would have -- who would have the final</p> <p>17 approval on language like this in a storage</p> <p>18 solution guide?</p> <p>19 A. It would have been the directors of</p> <p>20 product marketing for the various products and the</p> <p>21 product marketers on specific product lines.</p> <p>22 Q. When you read that the external storage</p> <p>23 solutions are sleek, dependable and ultra portable,</p> <p>24 what do you understand that to mean?</p> <p>25 MR. POPOVIC: Object on relevance grounds.</p>
<p style="text-align: right;">Page 35</p> <p>1 being listed as Americas, and it says "AMER," which</p> <p>2 is our abbreviation for Americas.</p> <p>3 Q. When did you stop creating storage</p> <p>4 solution guides by region?</p> <p>5 MR. POPOVIC: Objection. Lack of</p> <p>6 foundation.</p> <p>7 THE WITNESS: It varied over time.</p> <p>8 BY MS. BEDE:</p> <p>9 Q. Okay. If you can turn to just the second</p> <p>10 page there. Actually, it's the third page. It</p> <p>11 shows sort of the external products that are</p> <p>12 covered in this storage solution guide; is that</p> <p>13 right?</p> <p>14 A. Yes.</p> <p>15 Q. And it includes the Backup Plus, the</p> <p>16 Backup Plus for Mac, and the Backup Plus Desk. Do</p> <p>17 you see those ones?</p> <p>18 A. I do.</p> <p>19 Q. Okay. As well as it also covers other</p> <p>20 external storage products, right?</p> <p>21 A. Correct.</p> <p>22 Q. So on the following page, do you see where</p> <p>23 it says "External storage solutions"?</p> <p>24 A. Yes.</p> <p>25 Q. And there's a phrase underneath there that</p>	<p style="text-align: right;">Page 37</p> <p>1 THE WITNESS: To me, those words are</p> <p>2 descriptive themselves. But to me, that means that</p> <p>3 we have products that can be mobile and carried</p> <p>4 with you.</p> <p>5 BY MS. BEDE:</p> <p>6 Q. What about the word "dependable"?</p> <p>7 A. "Dependable" would imply that they are</p> <p>8 high quality.</p> <p>9 Q. Okay. Let's go to Page 9. I may have the</p> <p>10 pages wrong here. Hold on. Yeah, there we go. To</p> <p>11 page -- so at the bottom there, Page 14, 15, where</p> <p>12 it lists the internal storage comparisons.</p> <p>13 A. Got it.</p> <p>14 Q. And so on this page, it includes the</p> <p>15 Barracuda -- includes the Barracuda, right?</p> <p>16 A. Correct.</p> <p>17 Q. So then Page 19 -- I'm sorry, Page 17. It</p> <p>18 lists more specifications for the Barracuda 3.5</p> <p>19 inch internal kit and the Barracuda, right?</p> <p>20 A. I'm not sure I'm on the right page with</p> <p>21 you. Oh, yes, I am on the right page with you.</p> <p>22 Yes.</p> <p>23 Q. On the upper right-hand corner there.</p> <p>24 A. I see it. Yes.</p> <p>25 Q. When it lists under both of those, it's</p>

August 18, 2017

62 to 65

<p style="text-align: right;">Page 62</p> <p>1 expectations of how many drives out of 100 would</p> <p>2 fail.</p> <p>3 Q. So is it fair, then -- I'm paraphrasing,</p> <p>4 so tell me if I'm wrong. Is it fair to say that</p> <p>5 AFR is listed under reliability because it could</p> <p>6 indicate how reliable a particular product is?</p> <p>7 A. Seems like it would be one indication of</p> <p>8 that. Yes.</p> <p>9 MS. BEDE: Okay. Tab 12, please.</p> <p>10 (Exhibit 9 was marked for identification.)</p> <p>11 THE WITNESS: Okay. Yes, I have this.</p> <p>12 BY MS. BEDE:</p> <p>13 Q. Have you ever seen this before?</p> <p>14 A. I've never seen this document before. No.</p> <p>15 To my knowledge.</p> <p>16 Q. What's the date on the front?</p> <p>17 A. It is April 28th, 2011.</p> <p>18 Q. So this was created about -- during the</p> <p>19 time at which Exhibit 8 was in place, that product</p> <p>20 manual of April 2011, right?</p> <p>21 MR. POPOVIC: Objection. Lack of</p> <p>22 foundation.</p> <p>23 THE WITNESS: The dates on both documents</p> <p>24 are certainly close.</p> <p>25 BY MS. BEDE:</p>	<p style="text-align: right;">Page 64</p> <p>1 includes different Grenada models there.</p> <p>2 Do you see that?</p> <p>3 A. I do.</p> <p>4 Q. Do you see the Grenada three-terabyte, and</p> <p>5 then 79,995. Do you see that?</p> <p>6 A. Yes.</p> <p>7 Q. Do you understand this to be authorizing</p> <p>8 shipment of 79,995 Grenada three-terabyte units for</p> <p>9 the fourth quarter of 2011?</p> <p>10 MR. POPOVIC: Objection. Beyond the scope</p> <p>11 of the designated topic.</p> <p>12 THE WITNESS: Yeah. I don't know that</p> <p>13 that number is authorizing that exact number of</p> <p>14 shipment.</p> <p>15 BY MS. BEDE:</p> <p>16 Q. So generally, this document, though, does</p> <p>17 authorize shipment of the Grenada three-terabyte</p> <p>18 drives among others?</p> <p>19 A. Yes.</p> <p>20 Q. In 2011, right? Okay.</p> <p>21 Okay. So if you look at Page 8. At the</p> <p>22 top there, it says "Grenada NAT."</p> <p>23 Do you see that?</p> <p>24 A. Yes. Yes.</p> <p>25 MR. POPOVIC: What's the Bates number on</p>
<p style="text-align: right;">Page 63</p> <p>1 Q. Okay. If you look at Page 3 of this</p> <p>2 document. The top there says "SBS Ship Approval."</p> <p>3 Do you see that?</p> <p>4 A. Yes.</p> <p>5 Q. Have you seen documents that look like</p> <p>6 this before?</p> <p>7 A. I have.</p> <p>8 Q. What's your general understanding of what</p> <p>9 a document like this would be?</p> <p>10 MR. SHARMA: Again, this is focused on</p> <p>11 marketing or advertising statements? Is that the</p> <p>12 direction?</p> <p>13 THE WITNESS: Yes. So there's a launch</p> <p>14 process with any products going to market. And in</p> <p>15 that launch process, we have a phase gate process,</p> <p>16 a technology phase gate process, and this looks to</p> <p>17 be one of the last phases of the launch process,</p> <p>18 which is a authorization to ship.</p> <p>19 BY MS. BEDE:</p> <p>20 Q. And so this Page 3 says product name</p> <p>21 Grenada configuration, and includes the three-</p> <p>22 terabyte Grenada drives, right?</p> <p>23 A. Correct.</p> <p>24 Q. And if you hook at Page 4, in the upper</p> <p>25 right-hand corner, there's a little table, and it</p>	<p style="text-align: right;">Page 65</p> <p>1 that page? 704?</p> <p>2 MS. BEDE: 26704.</p> <p>3 MR. POPOVIC: Thank you.</p> <p>4 MS. BEDE: We are all on the same place?</p> <p>5 THE WITNESS: Yes.</p> <p>6 MR. POPOVIC: Yes, thanks.</p> <p>7 BY MS. BEDE:</p> <p>8 Q. So on this page, you see "AFR first year</p> <p>9 Weibull."</p> <p>10 Do you see that at the very top?</p> <p>11 A. Yes.</p> <p>12 Q. Do you have an understanding of what that</p> <p>13 means?</p> <p>14 MR. POPOVIC: Objection. Beyond the scope</p> <p>15 of the designated topic. And I just want to note</p> <p>16 for the record that to the extent this witness is</p> <p>17 answering questions that go beyond the scope of the</p> <p>18 designated topic, he's not answering for Seagate.</p> <p>19 Answer if you can.</p> <p>20 THE WITNESS: Yeah. I forget the exact</p> <p>21 question.</p> <p>22 MR. POPOVIC: Can we read it back?</p> <p>23 BY MS. BEDE:</p> <p>24 Q. Do you have an understanding of what "AFR</p> <p>25 first year Weibull" means.</p>

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86 to 89

<p style="text-align: right;">Page 86</p> <p>1 Q. Do you know why --</p> <p>2 A. So I was just going to say, I don't know</p> <p>3 how the math is actually derived.</p> <p>4 Q. Do you know why this AFR rate is --</p> <p>5 includes the power-on hours when the prior</p> <p>6 iterations of the product manual that did include</p> <p>7 AFR did not have that qualification?</p> <p>8 A. I don't.</p> <p>9 Q. And then if you look right underneath AFR,</p> <p>10 it says "maximum rated workload."</p> <p>11 Do you see that?</p> <p>12 A. Yes.</p> <p>13 Q. Am I correct that the wording there in</p> <p>14 that section no longer refers to the annualized</p> <p>15 failure rate, but instead uses the term "annualized</p> <p>16 rate"?</p> <p>17 A. It looks to use a term "annualized</p> <p>18 workload rate."</p> <p>19 Q. Do you have an understanding of what</p> <p>20 "annualized workload rate" is?</p> <p>21 A. Not enough that I would be comfortable</p> <p>22 describing it.</p> <p>23 Q. Is it fair to say that it's different, or</p> <p>24 do you know, is it different from AFR, from</p> <p>25 annualized failure rate?</p>	<p style="text-align: right;">Page 88</p> <p>1 that section there under rated workload now refers</p> <p>2 back to AFR.</p> <p>3 Do you see that?</p> <p>4 A. Yes.</p> <p>5 Q. Do you know why that change was made?</p> <p>6 A. I don't.</p> <p>7 Q. You can put that one aside. Tab 31.</p> <p>8 Exhibit 16.</p> <p>9 (Exhibit 16 was marked for</p> <p>10 identification.)</p> <p>11 BY MS. BEDE:</p> <p>12 Q. Have you seen this before?</p> <p>13 A. I don't believe so, but I may have glanced</p> <p>14 at it yesterday.</p> <p>15 Q. What's the date on it?</p> <p>16 A. It was sent September 24th, 2015.</p> <p>17 Q. This was made at or around the time of the</p> <p>18 September 2015 product manual, Exhibit 15 that we</p> <p>19 just looked at, right?</p> <p>20 A. Yes.</p> <p>21 Q. And it's from Carl Schweiss again?</p> <p>22 A. Yes.</p> <p>23 Q. Do you know who Lawrence Sim, is?</p> <p>24 A. I don't.</p> <p>25 Q. Do you know who Keith Myers is?</p>
<p style="text-align: right;">Page 87</p> <p>1 A. I don't know that.</p> <p>2 Q. Do you know why the AFR rate here is less</p> <p>3 than one percent, and not the 0.34 percent that we</p> <p>4 saw in the April 2011?</p> <p>5 A. I don't know.</p> <p>6 Q. Okay. You can put that one aside.</p> <p>7 Tab, 30 please. Exhibit 15.</p> <p>8 (Exhibit 15 was marked for</p> <p>9 identification.)</p> <p>10 THE WITNESS: Okay.</p> <p>11 BY MS. BEDE:</p> <p>12 Q. Okay. What is this?</p> <p>13 A. This is a Desktop HDD product manual, Gen</p> <p>14 14, from September 2014, and it includes the st3000</p> <p>15 model number.</p> <p>16 Q. Great. If you turn to Page 9, we are</p> <p>17 looking at this ever familiar Table 1 drive</p> <p>18 specifications again.</p> <p>19 A. Okay.</p> <p>20 Q. And you see "rated workload"?</p> <p>21 Do you know if rated workload is different</p> <p>22 from maximum rated workload that we saw in the</p> <p>23 January 2015 version?</p> <p>24 A. I don't.</p> <p>25 Q. Do you see where it says, the content of</p>	<p style="text-align: right;">Page 89</p> <p>1 A. The name is familiar, but no, I don't,</p> <p>2 actually.</p> <p>3 Q. Okay. So if you could flip to Page 4, at</p> <p>4 the very bottom of that page, there's an e-mail</p> <p>5 from Keith Myers on Wednesday, September 16th.</p> <p>6 Let me know when you see that.</p> <p>7 A. Bottom of Page 4, yes.</p> <p>8 Q. Then it starts, "All. Here's what LCO has</p> <p>9 update."</p> <p>10 What is "LCO"?</p> <p>11 A. LCO is the acronym for our Longmont,</p> <p>12 Colorado facility.</p> <p>13 Q. Is that the headquarters?</p> <p>14 A. Our headquarters is in Cupertino, but</p> <p>15 Longmont is a large facility, largely engineering</p> <p>16 based.</p> <p>17 Q. What is "DT"?</p> <p>18 A. That would mean Desktop.</p> <p>19 Q. So Mr. Keith Myers or somebody from his</p> <p>20 e-mail sends an e-mail updating language across all</p> <p>21 Desktop products include the Grenada; is that</p> <p>22 right?</p> <p>23 A. Appears to be correct.</p> <p>24 Q. And he provides the following language,</p> <p>25 starting with "Average annualized workload rating</p>

Jeffrey P. Friedman

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130 to 133

<p style="text-align: right;">Page 130</p> <p>1 because of the different perceptions that that may</p> <p>2 have. For me, reliability comes with the term</p> <p>3 "high quality."</p> <p>4 BY MS. BEDE:</p> <p>5 Q. Is that what Seagate understands consumers</p> <p>6 to know the word "reliability" as?</p> <p>7 A. In my perspective, yes.</p> <p>8 Q. When you say "high quality," what are</p> <p>9 features encompassed in high quality?</p> <p>10 A. Made of good components, thoughtfully put</p> <p>11 together, tested.</p> <p>12 Q. Okay. If you could look at the back,</p> <p>13 please. That familiar reliability/data integrity</p> <p>14 section. AFR is still not listed in there, right?</p> <p>15 A. Correct.</p> <p>16 Q. And you don't have an understanding as to</p> <p>17 why that is?</p> <p>18 A. No.</p> <p>19 Q. Do you need a break now? Are you okay for</p> <p>20 a little bit?</p> <p>21 A. I'm good.</p> <p>22 Q. So we have talked a little bit about</p> <p>23 specifications and marketing -- excuse me, and</p> <p>24 Seagate's both obligation and attempts to keep the</p> <p>25 marketing in line with those -- accuracy of the</p>	<p style="text-align: right;">Page 132</p> <p>1 being able to flag anything even related to</p> <p>2 reliability or an AFR issue.</p> <p>3 Q. Okay. That's fair. So slightly</p> <p>4 different, then. So if Seagate became aware in any</p> <p>5 fashion that a failure rate was higher than what</p> <p>6 was originally put on marketing materials, do you</p> <p>7 think the marketing materials should be adjusted</p> <p>8 accordingly?</p> <p>9 MR. POPOVIC: Objection. Incomplete</p> <p>10 hypothetical.</p> <p>11 THE WITNESS: I think at Seagate</p> <p>12 marketing, we always try to have the most accurate</p> <p>13 information. So if information that we have out is</p> <p>14 inaccurate, yes, I would expect we would flag that</p> <p>15 and change that.</p> <p>16 BY MS. BEDE:</p> <p>17 Q. Including failure rate information?</p> <p>18 A. That could be included.</p> <p>19 Q. Okay. So Tab 47, please. We are at</p> <p>20 Exhibit 26.</p> <p>21 (Exhibit 26 was marked for</p> <p>22 identification.)</p> <p>23 THE WITNESS: Okay. I have it.</p> <p>24 BY MS. BEDE:</p> <p>25 Q. Have you seen this before?</p>
<p style="text-align: right;">Page 131</p> <p>1 specifications, right?</p> <p>2 So do you agree that marketing generally</p> <p>3 should be in line with Seagate's knowledge of how</p> <p>4 the products perform; is that fair?</p> <p>5 A. Yes.</p> <p>6 Q. And we talked about how customer support</p> <p>7 would be a source of information for sort of real</p> <p>8 world feedback from customers. So as feedback, as</p> <p>9 performance feedback comes in as the product is</p> <p>10 sold, and it differs from what maybe was -- from</p> <p>11 what was originally stated in marketing materials,</p> <p>12 do you think that Seagate has an obligation to</p> <p>13 adjust those marketing materials accordingly?</p> <p>14 MR. POPOVIC: Objection. Vague.</p> <p>15 Incomplete hypothetical.</p> <p>16 THE WITNESS: I think it would be highly</p> <p>17 dependent on what the incoming information is.</p> <p>18 BY MS. BEDE:</p> <p>19 Q. So if there were -- again, hypothetical.</p> <p>20 If there were higher failure rates than what was</p> <p>21 originally advertised, do you think Seagate would</p> <p>22 have an obligation to update the marketing</p> <p>23 materials accordingly?</p> <p>24 A. It's a hypothetical that -- I would assume</p> <p>25 yes. I've never heard of our customer support</p>	<p style="text-align: right;">Page 133</p> <p>1 A. I have not. I'm on it. So maybe I have.</p> <p>2 I don't recall it.</p> <p>3 Q. Who is Troy Beaty?</p> <p>4 A. He was a gentleman in our reliability</p> <p>5 department. I don't think he's with our company</p> <p>6 anymore, but I'm not sure.</p> <p>7 Q. And the date on this e-mail is June 25th,</p> <p>8 2012, right?</p> <p>9 A. Yes.</p> <p>10 Q. And the subject says, "Backup Plus</p> <p>11 release, daily status, day 15," right?</p> <p>12 A. Yes.</p> <p>13 Q. This implies to me that this is sort of a</p> <p>14 daily e-mail. Do you have any information about</p> <p>15 that or knowledge about that?</p> <p>16 A. Yeah, I do have knowledge on this. So</p> <p>17 this would be, we had just launched a new product</p> <p>18 line. We had done a big name change in our</p> <p>19 consumer division, and launched a new product ID.</p> <p>20 Fairly major change in our -- in a large volume</p> <p>21 sector of our consumer business. And sometimes</p> <p>22 when we do that, we want to really watch those</p> <p>23 first days or couple of weeks that we launch to</p> <p>24 make sure that it's going as planned. So this is</p> <p>25 not unusual, and could continue for a couple weeks.</p>

Jeffrey Fohtman
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202 to 205


<p style="text-align: right;">Page 202</p> <p>1 sure whether -- I think -- it depends. If she</p> <p>2 orders one --</p> <p>3 THE REPORTER: You can let us know if</p> <p>4 you'd like that expedited. You have my card.</p> <p>5 MS. BEDE: Ill take a rough, please.</p> <p>6 (Deposition concluded at: 4:04 p.m.)</p> <p>7</p> <p>8</p> <p>9</p> <p>10</p> <p>11</p> <p>12</p> <p>13</p> <p>14</p> <p>15</p> <p>16</p> <p>17</p> <p>18</p> <p>19</p> <p>20</p> <p>21</p> <p>22</p> <p>23</p> <p>24</p> <p>25</p>	<p style="text-align: right;">Page 204</p> <p style="text-align: center;">DEPOSITION ERRATA SHEET</p> <p>2 Page No. _____ Line No. _____</p> <p>3 Change: _____</p> <p>4 Page No. _____ Line No. _____</p> <p>5 Change: _____</p> <p>6 Page No. _____ Line No. _____</p> <p>7 Change: _____</p> <p>8 Page No. _____ Line No. _____</p> <p>9 Change: _____</p> <p>10 Page No. _____ Line No. _____</p> <p>11 Change: _____</p> <p>12 Page No. _____ Line No. _____</p> <p>13 Change: _____</p> <p>14 Page No. _____ Line No. _____</p> <p>15 Change: _____</p> <p>16 Page No. _____ Line No. _____</p> <p>17 Change: _____</p> <p>18 Page No. _____ Line No. _____</p> <p>19 Change: _____</p> <p>20 Page No. _____ Line No. _____</p> <p>21 Change: _____</p> <p>22</p> <p>23 _____</p> <p>24 JEFFREY FOCHTMAN DATED</p> <p>25</p>
<p style="text-align: right;">Page 203</p> <p style="text-align: center;">DECLARATION UNDER PENALTY OF PERJURY</p> <p>2</p> <p>3</p> <p>4 I, JEFFREY FOCHTMAN, do hereby certify</p> <p>5 under penalty of perjury that I have read the</p> <p>6 foregoing transcript of my deposition taken on</p> <p>7 August 18, 2017; that I have made such corrections</p> <p>8 as appear noted on the Deposition Errata Page,</p> <p>9 attached hereto, signed by me; that my testimony as</p> <p>10 contained herein as corrected, is true and correct.</p> <p>11 Dated this _____ day of _____,</p> <p>12 2017 at _____, California.</p> <p>13</p> <p>14</p> <p>15</p> <p>16</p> <p>17 _____</p> <p>18 JEFFREY FOCHTMAN</p> <p>19</p> <p>20</p> <p>21</p> <p>22</p> <p>23</p> <p>24</p> <p>25</p>	<p style="text-align: right;">Page 205</p> <p style="text-align: center;">C E R T I F I C A T E</p> <p>2 STATE OF CALIFORNIA)</p> <p>3 COUNTY OF SAN FRANCISCO)</p> <p>4 I, LINDA VACCAREZZA, a Certified Reporter, certify</p> <p>5 the foregoing proceedings were taken before me at the</p> <p>6 time and place therein set forth, at which time the</p> <p>7 witness was put under oath by me;</p> <p>8 That the testimony of the witness, the</p> <p>9 questions propounded, and all objections and</p> <p>10 statements made at the time of the examination were</p> <p>11 recorded stenographically by me and were thereafter</p> <p>12 transcribed;</p> <p>13 That a review of the transcript by the</p> <p>14 deponent was requested;</p> <p>15 That the foregoing is a true and correct</p> <p>16 transcript of my shorthand notes so taken.</p> <p>17 I further certify that I am not a relative or</p> <p>18 employee of any attorney of the parties, nor</p> <p>19 financially interested in the action.</p> <p>20 I declare under penalty of perjury under the</p> <p>21 laws of California that the foregoing is true and</p> <p>22 correct.</p> <p>23 Dated this 21st day of August, 2017</p> <p>24 </p> <p>25 LINDA VACCAREZZA, CSR. NO. 10201</p>

EXHIBIT 11



Data Sheet

Barracuda®

The Power of One

Key Advantages

- Double your capacity and drive down costs with the industry's first 1TB-per-disk hard drive technology.
- Up to 3TB capacity with 7200-RPM performance. Why compromise?
- SATA 6Gb/s interface optimizes burst performance
- Seagate AcuTrac™ servo technology delivers dependable performance, even with hard drive track widths of only 75 nanometers.
- Seagate OptiCache™ technology boosts overall performance by as much as 45% over the previous generation.
- Seagate SmartAlign™ technology provides a simple, transparent migration to Advanced Format 4K sectors.
- Free Seagate DiscWizard™ software allows you to install a 3TB hard drive in Windows, including XP, without UEFI BIOS.

Best-Fit Applications

- Desktop or all-in-one PCs
- Home servers
- PC-based gaming systems
- Desktop RAID
- Direct-attached external storage devices (DAS)
- Network-attached storage devices (NAS)



Barracuda®
The Power of One



Specifications	3TB ¹	2TB ¹	1.5 ¹ TB	1TB ¹	75 ¹ 0GB	5 ¹ 00GB	320GB ¹	25 ¹ 0GB
Model Number	ST3000DM001	ST2000DM001	ST1500DM003	ST1000DM003	ST750DM003	ST500DM002 ²	ST320DM000 ²	ST250DM000 ²
Interface Options	SATA 6Gb/s NQ	SATA 6Gb/s NQ	SATA 6Gb/s NQ	SATA 6Gb/s NQ	SATA 6Gb/s NQ	SATA 6Gb/s NQ	SATA 6Gb/s NQ	SATA 6Gb/s NQ
Performance								
Spindle Speed (RPM)	7200	7200	7200	7200	7200	7200	7200	7200
Cache, Multisegmented (MB)	64	64	64	64	64	16	16	16
SATA Transfer Rates Supported (Gb/s)	6.0/3.0/1.5	6.0/3.0/1.5	6.0/3.0/1.5	6.0/3.0/1.5	6.0/3.0/1.5	6.0/3.0/1.5	6.0/3.0/1.5	6.0/3.0/1.5
Seek Average, Read (ms)	<8.5	<8.5	<8.5	<8.5	<8.5	<11	<11	<11
Seek Average, Write (ms)	<9.5	<9.5	<9.5	<9.5	<9.5	<12	<12	<12
Average Data Rate, Read/Write (MB/s)	156	156	156	156	156	125	125	125
Max Sustained Data Rate, CD Read (MB/s)	210	210	210	210	210	144	144	144
Configuration/Organization								
Heads/Disks	6/3	6/3	4/2	2/1	2/1	2/1	2/1	1/1
Bytes per Sector	4096	4096	4096	4096	4096	4096 or 512 ²	4096 or 512 ²	4096 or 512 ²
Voltage								
Voltage Tolerance, Including Noise (5V)	+10%/-5.0%	+10%/-5.0%	+10%/-5.0%	+10%/-5.0%	+10%/-5.0%	+10%/-5.0%	+10%/-5.0%	+10%/-5.0%
Voltage Tolerance, Including Noise (12V)	+10%/-7.5%	+10%/-7.5%	+10%/-7.5%	+10%/-7.5%	+10%/-7.5%	+10%/-7.5%	+10%/-7.5%	+10%/-7.5%
Reliability/Data Integrity								
Contact Start/Stop Cycles	—	—	—	—	—	50,000	50,000	50,000
Load/Unload Cycles	300,000	300,000	300,000	300,000	300,000	—	—	—
Nonrecoverable Read Errors per Bits Read, Max	1 per 10E14	1 per 10E14	1 per 10E14	1 per 10E14	1 per 10E14	1 per 10E14	1 per 10E14	1 per 10E14
Annualized Failure Rate (AFR)	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%
Power-On Hours	2400	2400	2400	2400	2400	2400	2400	2400
Power Management								
Startup Power (A)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Operating Mode, Typical (W)	8.0	8.0	6.70	5.90	5.90	6.19	6.19	6.19
Idle2 Average (W)	5.40	5.40	4.50	3.36	3.36	—	—	—
Idle Average (W)	—	—	—	—	—	4.60	4.60	4.60
Standby Mode (W)	0.75	0.75	0.75	0.63	0.63	0.79	0.79	0.79
Sleep Mode (W)	0.75	0.75	0.75	0.63	0.63	0.79	0.79	0.79
Environmental								
Temperature								
Operating (ambient min °C)	0	0	0	0	0	0	0	0
Operating (drive case max °C)	60	60	60	60	60	60	60	60
Nonoperating (ambient °C)	-40 to 70	-40 to 70	-40 to 70	-40 to 70	-40 to 70	-40 to 70	-40 to 70	-40 to 70
Physical								
Height (mm/in)	26.11/1.028	26.11/1.028	26.11/1.028	20.17/0.7825	20.17/0.7825	19.98/0.787	19.98/0.787	19.98/0.787
Width (mm/in)	101.6/4.0	101.6/4.0	101.6/4.0	101.6/4.0	101.6/4.0	101.6/4.0	101.6/4.0	101.6/4.0
Depth (mm/in)	146.99/5.787	146.99/5.787	146.99/5.787	146.99/5.787	146.99/5.787	146.99/5.787	146.99/5.787	146.99/5.787
Weight (g/lb)	626/1.38	626/1.38	535/1.18	400/0.88	400/0.88	415/0.92	415/0.92	415/0.92
Carton Unit Quantity	20	20	20	25	25	25	25	25
Cartons per Layer	40	40	40	40	40	40	40	40
Cartons per Pallet	8	8	8	8	8	8	8	8
Special Features								
Seagate OptiCache™ Technology	Yes	Yes	Yes	Yes	Yes	No	No	No
Seagate AcuTrac™ Technology	Yes	Yes	Yes	Yes	Yes	No	No	No
Seagate SmartAlign™ Technology	Yes	Yes	Yes	Yes	Yes	Yes ²	Yes ²	Yes ²

¹ One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes when referring to drive capacity.

² Seagate implements drives in both 4K- and 512-byte sectors. SmartAlign technology is included on 4K sector drives. Both drives are functionally and physically equivalent.

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 ASIA/PACIFIC Seagate Singapore International Headquarters Pte. Ltd., 7000 Ang Mo Kio Avenue 6, Singapore 569677, 65-6485-3888
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EXHIBIT 12



Storage Solutions Guide

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The Best Storage Solutions Are Here

This guide offers up-to-date details and specifications for all Seagate® products. From the world's fastest, largest-capacity desktop drives to external storage solutions that allow you to access your files anytime, anywhere.



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AT-A-GLANCE PRODUCT COMPARISON

External Storage

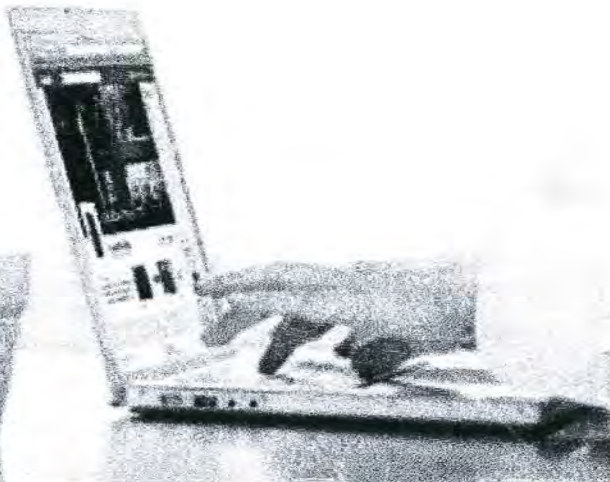
At-a-Glance Product Comparison

	Backup Plus®								Expansion	
Direct Attached/ Portable										
	Backup Plus™	Backup Plus™ for Mac	Backup Plus™ Turbo	Backup Plus™ Pro for Mac	Backup Plus™ Slim	Backup Plus™ Slim for Mac	Backup Plus™ Desk	Backup Plus™ Desk for Mac	Expansion External	Expansion Portable
PERFECT FOR	Compact storage on the go				TBD	TBD	Satisfying high-capacity cravings		Plug-and-play add-on desktop storage	
DESCRIPTION	These ultra-portable, ultra-upgradable drives make it easy to store and protect all your files, automatically and continuously. PC or Mac.				TBD		Store and protect all your photos, music, videos and documents with this powerful, high-capacity desktop storage solution. PC or Mac.		Instant add-on storage for your ever-growing collection of files lets you free space on your internal drive. PC or Mac.	
COMPATIBLE WITH WINDOWS 7										
LEARN MORE	Page X	Page X	Page X	Page X	Page X	Page X	Page X	Page X	Page X	Page X

	Backup Plus®		Backup Plus®	BLACKARMOR®		
Wireless Mobile						
	Backup Plus Satellite™		Backup Plus Home™	BlackArmor NAS 440	BlackArmor NAS 400	BlackArmor NAS 220
PERFECT FOR			Wireless centralized home storage	Full-system backup, RAID 0, 1, 5, 10 or JBOD		Full-system backup, RAID 0 or 1
DESCRIPTION			This network storage system supports the external storage needs of every computer in your home. PC or Mac.	A complete, small-business-specific network storage solution designed to provide optimum uptime and data integrity for up to 50 workstations.		A network attached storage solution designed to provide centralized storage and data backup.
COMPATIBLE WITH WINDOWS 7						
LEARN MORE	Page X		Page X	Page X	Page X	Page X

External Storage Solutions

Seagate external storage solutions are sleek, dependable and ultra-portable products that let your customers automatically and continuously store digital family photos, protect critical business data, back up multiple computers on a small network, or share and store videos and music.



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BACKUP PLUS



The Backup Plus ultra-portable drive makes it easy to store and protect all your files, automatically and continuously.



Key Advantages

- Plug and play interface
- Preloaded backup software with encryption
- USB 3.0, FireWire 800 or powered eSATA for fast transfers
- Access and share files from anywhere.
- View your movies and photos on your TV

Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Carry files while on the go.
- Access files with both PC and Mac computers.



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
1.5 Tb	STAA1500100	USB 3.0	● Black	PC, Mac
1 Tb	STAA1000100	USB 2.0	● Black	PC, Mac
1 Tb	STAA1000101	USB 3.0	● Black	PC, Mac
1 Tb	STAA1000102	USB 3.0	● Blue	PC, Mac
750 GB	STAA750100	USB 2.0	● Black	PC, Mac
750 GB	STAA750101	USB 3.0	● Black	PC, Mac
500 GB	STAA500105	USB 2.0	● Black	PC, Mac
500 GB	STAA500106	USB 2.0	● Silver	PC, Mac
500 GB	STAA500107	USB 2.0	● Blue	PC, Mac
500 GB	STAA500108	USB 2.0	● Red	PC, Mac
14.1 TB DRIVE2GO (15.1 TB 700 GB)		4.71-in L x 3.51-in W x 0.87-in D (120mm x 89mm x 22mm)		
14.1 TB DRIVE2GO (2000)		4.33-in L x 3.27-in W x 0.59-in D (110mm x 83mm x 15mm)		
16 TB DRIVE2GO (17.1 TB 700 GB)		5.20-in L x 1.73-in W x 0.54-in D (132mm x 44mm x 16mm)		
14.1 TB DRIVE2GO (2000)		4.33-in L x 3.27-in W x 0.59-in D (110mm x 83mm x 15mm)		
16 TB DRIVE2GO		5.20-in L x 1.73-in W x 0.54-in D (132mm x 44mm x 16mm)		

Capacity in TB equals one billion bytes and one terabyte. GB equals one billion bytes. Color is subject to change without notice. © 2015 Seagate Technology

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EXTERNAL STORAGE

Seagate Satellite

With Seagate Satellite mobile wireless storage, you can take your media library with you. Stream it to your iPad or Android tablet.



Key Advantages

- Take your media library with you on the go
- Stream media with up to 3 Wi-Fi enabled devices at the same time
- Automatically sync media and documents from your PC or Mac computer
- Up to 5 hours battery life¹

Best-Fit Applications

- Store and carry movies and other media on the go
- Share media with others
- Works with iPad or Android tablet

	CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
New	500GB	STP500101	USB 3.0	Black	PC, Mac
	PRODUCT DIMENSIONS (inches)	4.72-in L x 3.54-in W x 0.87-in D (120mm x 90mm x 22mm)			
	PRODUCT DIMENSIONS (mm)	630-in L x 6.69-in W x 2.13-in D (160mm x 170mm x 54mm)			

SATELLITE | BACKUP PLUS

backup plus turbo

The Backup Plus Turbo drive bundles high performance with extra data protection.



Key Advantages

- SafetyNet Data Recovery Services offer additional data protection if the drive fails for any reason
- USB 3.0 connectivity delivers up to 10x faster transfer speeds than USB 2.0 and backward compatibility
- Preloaded with automatic backup and encryption software
- Works with both PC and Mac computers

Best-Fit Applications

- Store or back up photos, movies, music, documents
- Read, write and share files between PC and Mac
- Carry files with you on-the-go

	CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
New	750GB	STB750103	USB 3.0	Black	PC, Mac
New	500GB	STB500103	USB 3.0	Black	PC, Mac
	PRODUCT DIMENSIONS (inches)	4.33-in L x 3.27-in W x 0.5-in D (110mm x 83mm x 13mm)			
	PRODUCT DIMENSIONS (mm)	4.92-in L x 3.27-in W x 0.5-in D (125mm x 83mm x 13mm)			
	PRODUCT DIMENSIONS (mm)	5.2-in L x 6.54-in W x 1.73-in D (132mm x 166mm x 44mm)			

backup plus for Mac

The Backup Plus for mac ultra-portable drive makes it ultra-easy to store, back up and retrieve files on-the-go from your mac computer.



Key Advantages

- Delivers plug-and-play connectivity with FireWire 800 or USB 2.0
- Time Machine software compatibility
- Makes it easy for you to upgrade to USB 3.0 and powered eSATA
- Use the same drive on both Mac and PC.

Best-Fit Applications

- Read, write and share files between Mac and PC computers
- Carry files while on-the-go
- Store files or back up using Time Machine

	CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
New	1.6TB	STBA1600100	FireWire 800/USB 2.0	Silver	PC, Mac
New	1TB	STBA1000100	FireWire 800/USB 2.0	Silver	PC, Mac
New	500GB	STBA50010	USB 2.0	Silver	PC, Mac
	PRODUCT DIMENSIONS (inches)	4.71-in L x 3.51-in W x 0.87-in D (120mm x 89mm x 22mm)			
	PRODUCT DIMENSIONS (mm)	4.39-in L x 3.19-in W x 0.57-in D (111mm x 83mm x 14mm)			
	PRODUCT DIMENSIONS (mm)	6.1-in L x 1.73-in W x 4.69-in D (157mm x 45mm x 119mm)			

backup pluspro for Mac

The Backup Plus Pro for mac ultra-portable drive gives you the flexibility you need to extend your digital life wherever you go.



Key Advantages

- High-performance 7200-RPM drive
- FireWire 800 or USB 2.0 plug-and-play
- Compatible with Time Machine software
- Upgradable to USB 3.0 and powered eSATA
- Use the same drive on both Mac and PC computers

Best-Fit Applications

- Store files or back up using Time Machine
- Read, write and share files between Mac and PC
- Carry files with you on-the-go

	CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
New	750GB	STBB750100	FireWire 800/USB 2.0	Black	PC, Mac
New	500GB	STBB500100	FireWire 800/USB 2.0	Black	PC, Mac
	PRODUCT DIMENSIONS (inches)	4.72-in L x 3.46-in W x 0.86-in D (120mm x 88mm x 22mm)			
	PRODUCT DIMENSIONS (mm)	5.63-in L x 6.3-in W x 2.17-in D (143mm x 160mm x 53mm)			

EXTERNAL STORAGE

backup plusSlim

The ultra-cool Backup Plus Slim performance drive delivers ultra-fast, ultra-portable on-the-go storage.



Key Advantages

- Features a sleek, ultra-thin anodized design
- Delivers USB 3.0 connectivity and performance
- Includes preloaded premium backup software with encryption and synchronization
- Works with both Mac and PC computers

Best-Fit Applications

- Increase storage capacity for mobile devices
- Carry files with you anywhere and everywhere
- Read, write and share files between Mac and PC
- Help keep files safe and secure

	CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
New	500GB	STBS500100	USB 3.0	● Black	PC, Mac
New	1TB	STBS100100	USB 3.0	● Black	PC, Mac
	PRODUCT DIMENSIONS	4.91-in L x 3.07-in W x 0.354-in D (124mm x 78mm x 9mm)			
	PACKAGE DIMENSIONS	6.30-in L x 2.56-in W x 4.21-in D (160mm x 65mm x 107mm)			

backup plusSlim for Mac

The Backup Plus for mac performance drive has a sleek, ultra-thin enclosure and is Time machine-ready.



Key Advantages

- Sleek, ultra-thin anodized design
- Compatible with Time Machine software
- USB 2.0 plug-and-play
- Use the same drive on both Mac and PC computers

Best-Fit Applications

- Increase storage capacity for mobile devices
- Carry files with you anywhere and everywhere
- Read, write and share files between Mac and PC

	CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
New	500GB	STBS500100	USB 3.0	● Black	PC, Mac
New	1TB	STBS100100	USB 3.0	● Black	PC, Mac
	PRODUCT DIMENSIONS	4.91-in L x 3.07-in W x 0.354-in D (124mm x 78mm x 9mm)			
	PACKAGE DIMENSIONS	6.30-in L x 2.56-in W x 4.21-in D (160mm x 65mm x 107mm)			

BACKUP PLUS

backup plusDesk

The Backup Plus Desk external drive delivers high-capacity storage and automatic, continuous backup and encryption with its preloaded software.



Key Advantages

- Plug-and-play interface
- Preloaded premium backup software with encryption
- USB 2.0 or USB 3.0 adapter with capacity gauge display
- Upgrade to a faster interface with a Backup Plus desk adapter
- Offers both vertical and horizontal drive orientation

Best-Fit Applications

- Store or back up photos, movies, music and documents
- Access files with both PC and Mac computers

	CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
New	4TB	STAC4000100	USB 3.0	● Black	PC, Mac
	3TB	STAC3000100	USB 2.0	● Black	PC, Mac
New	3TB	STAC3000102	USB 3.0	● Black	PC, Mac
	2TB	STAC2000100	USB 2.0	● Black	PC, Mac
New	2TB	STAC2000106	USB 3.0	● Black	PC, Mac
	1TB	STAC1000100	USB 2.0	● Black	PC, Mac
New	1TB	STAC1000103	USB 3.0	● Black	PC, Mac
	PRODUCT DIMENSIONS	6.22-in L x 4.86-in W x 1.73-in D (158mm x 124mm x 44mm)			
	PACKAGE DIMENSIONS	7.87-in L x 9.06-in W x 3.54-in D (200mm x 230mm x 90mm)			

backup plusDesk for Mac

The Backup Plus Desk for mac delivers high-capacity storage and Time machine compatibility for your mac computer.



Key Advantages

- FireWire 800 or USB 2.0 plug-and-play
- Use the same drive on both Mac and PC computers
- Upgradable to USB 3.0
- FireWire 800/USB 2.0 desktop adapter with capacity gauge display
- Both vertical and horizontal drive orientation

Best-Fit Applications

- Back up using Time Machine software
- Read, write and share files between Mac and PC
- Take advantage of faster FireWire 800 interface
- Expand storage capacity

	CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
New	4TB	STBC4000100	FireWire 800/USB 2.0	● Black	PC, Mac
New	3TB	STBC3000101	FireWire 800/USB 2.0	● Black	PC, Mac
New	2TB	STBC2000101	FireWire 800/USB 2.0	● Black	PC, Mac
	PRODUCT DIMENSIONS	6.22-in L x 4.86-in W x 1.73-in D (158 x 124mm x 44mm)			
	PACKAGE DIMENSIONS	7.87-in L x 9.06-in W x 3.54-in D (200mm x 230mm x 90mm)			

EXPANSION

BACKUP PLUS

Expansion External

Seagate external desktop drives provide instant add-on storage for your ever-growing collection of files.

Key Advantages

- Plug-and-play, no software to install
- Simply drag and drop to save files
- Built-in power management ensures energy-efficient operation

Best-Fit Applications

- Instantly add more storage space to your computer
- Free space on your internal hard drive to increase computer performance
- Consolidate all your files to a single location



	CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
New	3 TB	STAX3000102	USB 3.0	● Black	PC, Mac
New	2 TB	STAX2000102	USB 3.0	● Black	PC, Mac
New	1 TB	STAX1000102	USB 3.0	● Black	PC, Mac
PRODUCT DIMENSIONS (H x W x D)	4.96-in W x 1.57-in H x 8.15-in D (125.98mm x 39.88mm x 207.09mm)				
PRODUCT DIMENSIONS (H x W x D)	9.69-in W x 8.62-in H x 3.07-in D (246.12mm x 218.55mm x 77.97mm)				

Expansion Portable

Portable add-on storage lets you free space on your internal drive and take large files on the go.

Key Advantages

- Plug-and-play, no software to install
- Simply drag and drop to save files
- USB powered
- Built-in power management ensures energy-efficient operation

Best-Fit Applications

- Instantly add more storage space to your computer
- Take large files with you when you travel



	CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
New	1.5 TB	STAX1500102	USB 3.0	● Black	PC, Mac
New	1 TB	STAX1000102	USB 3.0	● Black	PC, Mac
New	750 GB	STAX750102	USB 3.0	● Black	PC, Mac
New	500 GB	STAX500102	USB 3.0	● Black	PC, Mac
PRODUCT DIMENSIONS (H x W x D)	3.31-in W x 1.06-in H x 5.97-in D (84.07mm x 26.92mm x 151.64mm)				
PRODUCT DIMENSIONS (H x W x D)	3.15-in W x 0.89-in H x 5.38-in D (80.01mm x 22.60mm x 136.65mm)				
PRODUCT DIMENSIONS (H x W x D)	5.20-in W x 1.73-in D x 6.54-in L (132.08mm x 43.94mm x 166.13mm)				

BACKUP PLUS

blackArmor[®]
nAS 440/400

A complete, small-business-specific network storage solution designed to provide optimum uptime and data integrity for up to 50 workstations.



Key Advantages

- BlackArmor NAS 440 models include four drives to increase capacity and take advantage of RAID 5/10 options.
- BlackArmor NAS 400 model available without pre-installed drives for maximum flexibility.
- Designed for small business to provide optimum uptime and data integrity.
- User-configurable RAID 0/1/5/10 and JBOD.
- Continuous and automatic full-system backup for network-connected workstations*.
- Hot-swappable, user-serviceable drives—no tools required.

Best-Fit Applications

- Store and access files from a central, secure location.
- Access and manage files remotely.
- Back up or move files to a secondary storage device.
- Automatically perform full-system backups on network-connect PCs.
- Share a USB printer with network-connected PCs and Macs.
- Encrypt individual files to entire volumes of data.
- Stream media with DLNA or iTunes.

CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
12TB	ST4U12000100	Gigabit Ethernet	Black	PC, Mac
8TB	ST3800059410GRK	Gigabit Ethernet	Black	PC, Mac
4TB	ST3400059410GRK	Gigabit Ethernet	Black	PC, Mac
—	STAR401	Gigabit Ethernet	Black	Mac
RECOMMENDED DIMENSIONS	6.36 in W x 8.15 in H x 10.59 in D (160.30mm x 207.00mm x 269.00mm)			
PACKAGE WEIGHT	9.29 in W x 8.50 in H x 14.37 in D (236.00mm x 214.30mm x 365.00mm)			

EXTERNAL STORAGE

blackArmor[®] nAS 220

A small-business-specific network attached storage solution designed for centralized storage and data backup for up to 20 PCs



Key Advantages

- Automatic data mirroring with RAID 1
- Protect network-connected PCs with incremental and full-system, automatic backup *
- Functions as FTP server for remote access
- Includes two reliable, user-replaceable drives
- Secure files with hardware-based encryption

Best-Fit Applications

- Central, secure file storage and access
- Access and manage files remotely
- Share a printer with connected PCs and Macs.








CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
500GB	STB500100	Gigabit Ethernet	Black	PC, Mac
100GB	STB320100	Gigabit Ethernet	Black	PC, Mac
RECOMMENDED DIMENSIONS	4.09 in W x 7.79 in H x 7.40 in D (104.00mm x 197.80mm x 188.00mm)			
PACKAGE WEIGHT	10.90 in W x 8.13 in H x 11.00 in D (276.66mm x 155.70mm x 279.40mm)			










* Requires a Windows or Mac system with backup software. © 2016 Seagate Technology LLC. All rights reserved. For more information, visit www.seagate.com.

AT-A-GLANCE PRODUCT COMPARISON

Internal Storage

At-a-Glance Product Comparison

	LAPTOP			ENTERPRISE			DVR
2.5-inch							
	Momentus® XT	Momentus	Momentus Thin	Sawio® 15K	Sawio® 10K	Constellation®	Pipeline HD® Mini
BUSINESS NEED	Extreme Performance	Mainstream	Slim Computing	Performance	Mainstream	Low Power	Mainstream
USE CASE DRIVE FOR	The ultimate mobile computing experience, with SSD-like performance for all applications and OS environments	Laptop PCs where the lowest power consumption, silent acoustics and the highest quality is always expected. Encryption models available	Slim computing devices such as thin laptops and netbooks, where z-height makes all the difference	Compute-intensive data requirements demanding the highest performance density and availability. Encryption models available	Mainstream data requiring high capacity, performance density and reliability. Encryption models available	Online reference data demands requiring cost-effective, low-power, enterprise-class drives. Encryption models available	Small form factor DVR applications where video streaming, power and acoustic performance are key
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	DESKTOP			ENTERPRISE			DVR	SURVEILLANCE	
3.5-inch									
	Barracuda® XT	Barracuda	Barracuda LP	Cheetah® 15K	Cheetah NS	Constellation ES	Pipeline HD®	SV35 Series®	Constellation ES
BUSINESS NEED	Performance	Mainstream	Low Power	Performance	Low Power	Capacity	Mainstream	Performance	Centralized
USE CASE DRIVE FOR	High-performance PC and workstations where big cache, maximum capacities and top-end performance are priorities	Mainstream desktop compute where choice in capacity and cache options to provide design flexibility is important	Lower-power applications where power conservation with good performance is required	High-capacity, compute-intensive requirements demanding high-performance and availability. Encryption models available	Mainstream data requiring high capacity, low power and high availability. Encryption models available	Maximum-capacity enterprise servers and storage arrays requiring enterprise-class reliability. Encryption models available	DVR systems where reliable, low-power, purpose-built storage is required for video streaming applications	Surveillance systems that require high-performance, low-power, ruggedized and centralized storage for every surveillance application	
LEARN MORE	Page X	Page X	Page X	Page X	Page X	Page X	Page X		

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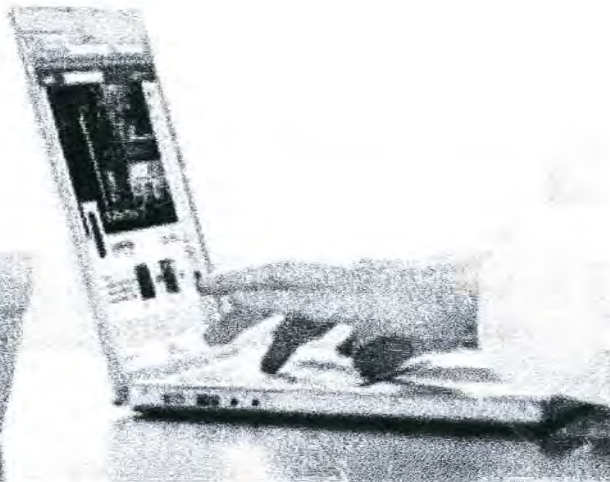
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Desktop Storage Solutions

Seagate has a distinguished history in consistently delivering innovative technologies, super-sized capacities, low power and blazing-fast performance. Seagate desktop drives offer excellent performance at all levels.



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DESKTOP STORAGE

Product Comparison

	BARRACUDA® 3.5-INCH INTERNAL KIT	BARRACUDA
Application	Mainstream	Mainstream and Performance
Description	The fast, powerful and easy way to upgrade or add storage capacity to desktop computers	Tuned performance for low-power, mainstream and high-performance desktop computing
Form Factor	3.5 inch	3.5 inch
Performance	7200 RPM	7200 RPM
Reliability (AFR)	<1%	<1%
Max. Sust. Transfer Rate	300MB/s to 600MB/s	600MB/s
Capacity	500GB to 3TB	250GB to 3TB
Interface	SATA 3Gb/s, SATA 6Gb/s	SATA 6Gb/s
Cache	16MB to 64MB	16MB to 64MB
Power (idle)		3.3W to 7.3W

Feature Comparison

	MAINSTREAM Barracuda 3.5-Inch Internal Kit	MAINSTREAM AND PERFORMANCE Barracuda
product	Barracuda 3.5-Inch Internal Kit	Barracuda
SATA/ATA interface	X	X
Sustainable technology	X	X
Best-in-Class performance		X
Capacity Leadership	X	X
Quiet Acoustics	X	
DiscoWiz® Installation Software	X	X
Compatible with Windows 7	X	X

*All capacities are 100% guaranteed. Performance results are typical. All figures are MB/s. Actual results may vary. For more information, visit www.seagate.com.
For more information, visit www.seagate.com.
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INTERNAL STORAGE

barracuda®

Seagate Barracuda drives give you the Power of One with 1TB-per-disk technology and one drive platform for every capacity and application.



Key Advantages

- Up to 3TB capacity with 7200-RPM performance
- AcuTrac™ and OptiCache™ technologies deliver dependable overall performance
- Seagate SmartAlign™ technology provides simple, migration to Advanced Format 4K sectors
- Free Seagate DiscWizard™ software

Best-Fit Applications

- Desktop or all-in-one PCs and home servers
- PC-based gaming systems
- Desktop RAID
- Direct-attached external storage devices (DAS)
- Network-attached storage devices (NAS)

	CAPACITY	MODEL	INTERFACE	CACHE
New	3TB	ST3000DM001	SATA 6Gb/s NQ	64MB
New	2TB	ST2000DM001	SATA 6Gb/s NQ	64MB
New	1.5TB	ST1500DM003	SATA 6Gb/s NQ	64MB
New	1TB	ST1000DM003	SATA 6Gb/s NQ	64MB
New	750GB	ST750DM003	SATA 6Gb/s NQ	64MB
New	500GB	ST500DM002	SATA 6Gb/s NQ	16MB
New	300GB	ST300DM000	SATA 6Gb/s NQ	16MB
New	150GB	ST250DM000	SATA 6Gb/s NQ	16MB

barracuda® 3.5-Inch Internal kit

Seagate 3.5-inch internal drives are the fast, powerful, and easy way to upgrade or add storage capacity to desktop computers.



Key Advantages

- Quiet, ultra-high performance
- DiscWizard™ software makes installation a snap
- Built-in self-monitoring technology helps ensure maximum reliability

Best-Fit Applications

- Gaming PCs
- Workstations
- High-end PCs
- Desktop RAID
- Mainstream/office PCs

	CAPACITY	MODEL	RPM	INTERFACE
New	3TB	ST3000DM001	7200	SATA 6Gb/s
New	1.5TB	ST1500DM003	7200	SATA 6Gb/s
New	750GB	ST750DM003	7200	SATA 6Gb/s
Product Dimensions	7.38-in L x 5.85-in W x 2.88-in D (187mm x 148mm x 73mm)			

DESKTOP STORAGE

barracuda®

Seagate Barracuda drives give you the Power of One with 1TB-per-disk technology and one drive platform for every capacity and application.



Key Advantages

- Up to 3TB capacity with 7200-RPM performance
- AcuTrac™ and OptiCache™ technologies deliver dependable overall performance
- Seagate SmartAlign™ technology provides simple, migration to Advanced Format 4K sectors
- Free Seagate DiscWizard™ software

Best-Fit Applications

- Desktop or all-in-one PCs and home servers
- PC-based gaming systems
- Desktop RAID
- Direct-attached external storage devices (DAS)
- Network-attached storage devices (NAS)

	CAPACITY	MODEL	INTERFACE	CACHE
New	3TB	ST3000DM001	SATA 6Gb/s NQ	64MB
New	2TB	ST2000DM001	SATA 6Gb/s NQ	64MB
New	1.5TB	ST1500DM003	SATA 6Gb/s NQ	64MB
New	1TB	ST1000DM003	SATA 6Gb/s NQ	64MB
New	750GB	ST750DM003	SATA 6Gb/s NQ	64MB
New	500GB	ST500DM002	SATA 6Gb/s NQ	16MB
New	300GB	ST300DM000	SATA 6Gb/s NQ	16MB
New	150GB	ST250DM000	SATA 6Gb/s NQ	16MB

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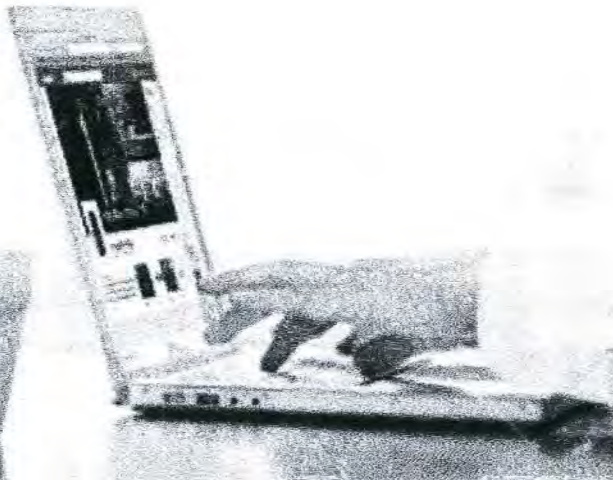
Best-Fit Applications

- Desktop or all-in-one PCs and home servers
- PC-based gaming systems
- Desktop RAID
- Direct-attached external storage devices (DAS)
- Network-attached storage devices (NAS)

	CAPACITY	MODEL	INTERFACE	CACHE
New	3TB	ST3000DM001	SATA 6Gb/s NQ	64MB
New	2TB	ST2000DM001	SATA 6Gb/s NQ	64MB
New	1.5TB	ST1500DM003	SATA 6Gb/s NQ	64MB
New	1TB	ST1000DM003	SATA 6Gb/s NQ	64MB
New	750GB	ST750DM003	SATA 6Gb/s NQ	64MB
New	500GB	ST500DM002	SATA 6Gb/s NQ	16MB
New	300GB	ST300DM000	SATA 6Gb/s NQ	16MB
New	150GB	ST250DM000	SATA 6Gb/s NQ	16MB

Laptop Storage Solutions

Seagate laptop drives address every mobile market need, delivering superior performance, reliability and value. Feature-rich with innovative options, the Seagate laptop lineup also includes self-encryption and FIPS 140-2 validated models.



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DESKTOP STORAGE

Product Comparison

				
	MOMENTUS® 2.5-INCH INTERNAL KIT	MOMENTUS XT	MOMENTUS	MOMENTUS THIN
Application	Mainstream and Performance	Extreme Performance	Mainstream	Slim Computing
Description	A complete upgrade kit to transform your system to high performance or just add capacity	Solid state hybrid drives deliver SSD-like performance without sacrificing capacity	The best combination of capacity, mobility and durability in a laptop hard drive	The world's thinnest 2.5-inch drive for slim laptops and netbooks
Form factor	2.5 inch	2.5 inch	2.5 inch	7mm, 2.5 inch
performance	5400 RPM to 7200 RPM	7200 RPM	5400 RPM to 7200 RPM	5400 RPM to 7200 RPM
Reliability (AFR)	0.40% to 0.50%	0.50%	0.48% to 0.50%	0.48%
Max. Ext. Transfer Rate	300MB/s	300MB/s to 600MB/s	300MB/s	300MB/s
Capacity	250GB to 750GB	500GB to 750GB	160GB to 750GB	160GB and 300GB
Interface	SATA 3Gb/s	SATA 3Gb/s, SATA 6Gb/s	SATA 3Gb/s	SATA 3Gb/s
Cache	8MB to 32MB	32MB	8MB to 16MB	16MB
Power (idle)		0.8W to 1.1W	0.5W to 0.8W	0.48% to 0.66%

Feature Comparison

				
	MAINSTREAM AND PERFORMANCE	EXTREME PERFORMANCE	MAINSTREAM	SLIM COMPUTING
product	Momentus 2.5-inch Internal Kit	Momentus XT	Momentus	Momentus Thin
SATA interface	X	X	X	X
Lowest Acoustics			X	X
Lowest power			X	X
Self-Encrypting Drive			X	X
Drop Sensor options			X	
Solid State hybrid	X	X		
Compatible with Windows 7	X	X	X	X

*The above table provides a high-level overview of the features of the drives. For a complete list of features, please visit the Seagate website at <http://www.seagate.com/technical-specs>.

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INTERNAL STORAGE

Moment $u^s t$

Experience the FAST Factor™ Advantage

The Seagate momentus xT solid-state hybrid-drive enables laptop PC users to enjoy solidstate performance without sacrificing capacity.



Key Advantages

- Boots and performs like an SSD¹
- Up to 3x faster than a traditional HDD²
- SATA 6Gb/s with NCQ for interface speed
- All-in-one design for simplicity and ease of installation
- Works in any laptop or PC, any OS and any application
- Backed by a 3-year limited warranty³

Best-Fit Applications

- Laptops and mobile workstations
- Desktop and tower workstations
- High-performance laptop and desktop gaming systems
- Small form factor all-in-one PCs

	CAPACITY	MODEL	INTERFACE	CACHE
New	750GB	ST750LM003	SATA 6Gb/s	32MB
	500GB	ST500MM002AS	SATA 3Gb/s	32MB
	320GB	ST320MM002AS	SATA 3Gb/s	32MB
	250GB	ST250MM002AS	SATA 3Gb/s	32MB

Moment us

The Seagate momentum drive offers the world's most feature-rich 2.5-inch family of storage for laptops and external enclosures.



Key Advantages

- Innovative options and features—the power to transform from ordinary to extraordinary
- 7200 RPM delivers a constant high-performance boost. 5400 RPM enables affordable, low-power and high-capacity drives for external enclosures.
- Self-Encrypting Drive options mitigate data breaches, comply with data protection regulations and preserve brand recognition.
- Self-Encrypting Drive options with FIPS 140-2 certification* are government-approved for the U.S. and Canadian governments.
- G-Force Protection™ technology can help keep your data recoverable after a fall, even if your laptop doesn't survive.
- Seagate SmartImage™ technology provides a transition to 4K sectors without the need for software utilities.

Best-Fit Applications

- Gaming PCs
- Workstations
- High-end PCs
- Desktop RAID
- Mainstream/office PCs

	CAPACITY	7200-RPM MODEL	INTERFACE	QoSE
New	7500r	ST9750420AS	SATA 3Gb/s	16MB
	5000r	ST9500420AS	SATA 3Gb/s	16MB
	5000r	ST9500420AS	SATA 3Gb/s	16MB
	5000r	ST9500421AS	SATA 3Gb/s	16MB
	5000r	ST9500422AS	SATA 3Gb/s	16MB
New	3200r	ST9320423AS	SATA 3Gb/s	16MB
	3200r	ST320L7023	SATA 3Gb/s	16MB
	3200r	ST9320424AS	SATA 3Gb/s	16MB
New	2500r	ST9250425AS	SATA 3Gb/s	16MB
	2500r	ST9250426AS	SATA 3Gb/s	16MB
New	2500r	ST9250420S3	SATA 3Gb/s	16MB
	2500r	ST9250421AS	SATA 3Gb/s	16MB
	2500r	ST9250422AS	SATA 3Gb/s	16MB
New	1600r	ST9160423AS	SATA 3Gb/s	16MB
	1600r	ST160L7016	SATA 3Gb/s	16MB

	CAPACITY	SATA-III/II MODEL	INTERFACE	CACHE
New	750GB	ST9750423AS	SATA 3Gb/s	16MB
	540GB	ST9540423AS	SATA 3Gb/s	8MB
	500GB	ST9500325AS	SATA 3Gb/s	8MB
	540GB	ST9540325AS	SATA 3Gb/s	8MB
	500GB	ST9500327AS	SATA 3Gb/s	8MB
New	320GB	ST3200225AS	SATA 3Gb/s	8MB
	320GB	ST3200225L	SATA 3Gb/s	16MB
	320GB	ST9320042AS	SATA 3Gb/s	16MB
New	250GB	ST9250021AS	SATA 3Gb/s	16MB
	750GB	ST9250317AS	SATA 3Gb/s	8MB
New	160GB	ST9160044S	SATA 3Gb/s	8MB
	160GB	ST9160071S	SATA 3Gb/s	16MB

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INTERNAL STORAGE

Momentus[®] thin

The 7mm, 2.5-inch drive enables slim computing for all types of mobile computing, from laptops to netbooks to smaller desktop PCs.

Key Advantages

- 7mm z-height form factor enables thin chassis design for all segments of laptop computing.
- Seagate SmartAlign™ technology provides a transition to 4K sectors without the need for software utilities.
- Self-Encrypting Drive options mitigate data breaches, comply with data protection regulations and preserve brand recognition.
- Self-Encrypting Drive options with FIPS 140-2 certification¹ are government-approved for the U.S. and Canadian governments.

Best-Fit Applications

- Desktop or all-in-one PCs and home servers
- PC-based gaming systems
- Desktop RAID
- Direct-attached external storage devices (DAS)
- Network-attached storage devices (NAS)



	CAPACITY ²	7200 RPM MODEL	INTERFACE	CACHE
New	320GB	ST320LT007	SATA 3Gb/s	16MB
New	320GB	ST320LT014 ³	SATA 3Gb/s	16MB
New	320GB	ST320LT009 ³	SATA 3Gb/s	16MB
New	250GB	ST250LT007	SATA 3Gb/s	16MB
New	250GB	ST250LT014 ³	SATA 3Gb/s	16MB
New	250GB	ST250LT009 ³	SATA 3Gb/s	16MB
New	160GB	ST160LT007	SATA 3Gb/s	16MB

	CAPACITY ²	5400 RPM MODEL	INTERFACE	CACHE
New	500GB	ST500LT012	SATA 3Gb/s	16MB
New	300GB	ST300LT003	SATA 3Gb/s	16MB
New	250GB	ST250LT003	SATA 3Gb/s	16MB
New	160GB	ST160LT003	SATA 3Gb/s	16MB

Momentus[®] 2.5-Inch Internal kit

Seagate 2.5-inch internal drives deliver vast amounts of storage for adding capacity or upgrading drives in laptop computers.

Key Advantages

- Built for mobility
- Preserves battery life
- Large data cache
- Outstanding performance
- Momentus XT solid state hybrid model offers SSD-like performance with the capacity of a hard drive.

Best-Fit Applications

- Replacement laptop drives
- Laptop storage upgrades
- High-end laptops and workstations



	CAPACITY ²	KT/NL/SSR	RPM	CACHE
New	750GB	ST9750320N1A1AS-RK	7200	SATA 3Gb/s
	540GB	ST9540430V1A1AS-RK	5400	SATA 3Gb/s
New	400GB	ST940060030A1AS-RK	7200	SATA 3Gb/s
	300GB	ST930060030V1A1AS-RK	5400	SATA 3Gb/s
	250GB	ST925032030A1AS-RK	7200	SATA 3Gb/s
	160GB	ST916032030V1A1AS-RK	5400	SATA 3Gb/s
	250GB	ST9250250N1A1AS-RK	5400	SATA 3Gb/s

PHYSICAL DIMENSIONS: 6.25-in L x 4.75-in W x 2.25-in D (159mm x 121mm x 57mm)

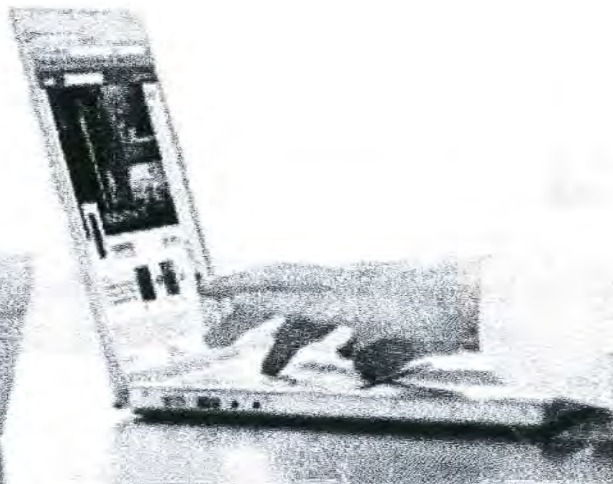
	MOMENTUS XT MODEL	RPM	CACHE
750GB	ST9750100	7200	SATA 3Gb/s
PHYSICAL DIMENSIONS	6.25-in L x 4.75-in W x 2.25-in D (159mm x 121mm x 57mm)		

¹Seagate's self-encrypting drives are available in 128-bit and 256-bit encryption modes. For more information, visit www.seagate.com.
²For the latest capacity information, visit www.seagate.com.
³For the latest capacity information, visit www.seagate.com.

LAPTOP STORAGE

Enterprise Storage Solutions

Seagate has the enterprise storage expertise as well as the global presence, processes and resources to consistently support small or medium businesses and run a large data center with the industry's highest-quality enterprise storage products, including FIPS 140-2 validated models.



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ENTERPRISE STORAGE

Product Comparison



	SAVIO [®]	CHEETAH [®]	CONSTELLATION [®]	PULSAR [®]
Application	SFF Performance and Mainstream	UFF Performance and Mainstream	High Capacity and Low Power	Mainstream and Performance SSD
Description	Highest-performing, highly reliable 15K- and 10K-RPM enterprise hard drives in a 2.5-inch form factor	Highest-performing, highly reliable 15K- and 10K-RPM enterprise hard drives in a 3.5-inch form factor	High-capacity, lowest-power, reliable 7200-RPM enterprise hard drive in both 2.5- and 3.5-inch form factors	
Form factor	2.5-inch	3.5-inch	2.5-inch and 3.5-inch	2.5-inch
performance	15K-RPM and 10K-RPM	15K-RPM and 10K-RPM	7200-RPM	MLC and SLC
Reliability (AFR)	0.44%	0.55%	0.62% and 0.73%	0.44%
Capacity	300MB/s to 600MB/s	300GB to 600GB	250GB to 3TB	100GB to 800GB
power (idle)	3.5W to 4.4W	5.8W to 11.68W	2.53W to 7.7W	3.47W to 5.92W
Interface	6Gb/s SAS, 4Gb/s FC	6Gb/s SAS, 4Gb/s FC	6Gb/s SAS, SATA 6Gb/s	6Gb/s SAS, SATA 6Gb/s
Limited warranty	5 years	5 years	3 years and 5 years	5 years*

Feature Comparison



	2.5-inch Mission Critical	3.5-inch Mission Critical	2.5-inch Nearline	3.5-inch Nearline	Performance SSD	Mainstream SSD		
product	Savio 15K	Savio 10K	Cheetah 15K	Cheetah HS	Constellation	Constellation ES	Pulsar XT.2	Pulsar Z
best-in-class performance	X		X		X	X	TBD	TBD
Capacity Leadership		X	X	X		X	TBD	
vibration tolerance for Multi-Drive Stabilization	X	X	X	X	X	X	TBD	TBD
6Gb/s SAS interface	X	X	X	X	X	X	X	X
4Gb/s FC interface		X	X	X				
3Gb/s SATA interface					X	X	X	X
best-in-class power usage		X		X	X	X	TBD	TBD
powerChoice optimized idle power settings		X			X	X		
Self-Encrypting Drive (SED)	X	X	X		X	X	X	X
FIPS 140-2 SED**	X	X	X	X	X	X		

*Check for the SED option and the FIPS 140-2 validation on the Seagate website for the specific model.

**Check for the FIPS 140-2 validation on the Seagate website for the specific model.

***Check for the FIPS 140-2 validation on the Seagate website for the specific model.

****Check for the FIPS 140-2 validation on the Seagate website for the specific model.

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INTERNAL STORAGE

Savvio 10k

Seagate Savvio 10k drives deliver the optimal balance of capacity, performance and power in a 10k, 2.5-inch enterprise drive.



Key Advantages

- Highest-capacity enterprise SFF hard drive (up to 900GB)
- PowerChoice™ technology reduces power consumption
- First SFF 10K-RPM drive to support 4gb/s FC
- Protection Information (PI) option detects corruption of data in flight between the host system and the drive¹
- Self-Encrypting Drive (SED)² and FIPS 140-2 certified SED³ cut IT drive retirement costs and protect data. FIPS options meet government encryption compliance standards.

Best-Fit Applications

- Mission-critical servers and external storage arrays
- Power- and space-constrained data centers
- Compliance or data security initiatives

	CAPACITY	MODEL	INTERFACE	CACHE
New	900GB	ST960006SS	6Gb/s SAS	64MB
New	600GB	ST960076SS ²	6Gb/s SAS	64MB
New	600GB	ST960006SS ²	6Gb/s SAS	64MB
New	600GB	ST960080FC	6Gb/s SAS	64MB
New	600GB	ST960076SS	6Gb/s SAS	64MB
New	600GB	ST960010SS ²	6Gb/s SAS	64MB
	600GB	ST960006SS ²	6Gb/s SAS	64MB
	600GB	ST960020FC	6Gb/s SAS	64MB
	450GB	ST945006SS	6Gb/s SAS	64MB
	450GB	ST945020SS ²	6Gb/s SAS	64MB
	450GB	ST945006FC	6Gb/s SAS	64MB
	300GB	ST930006SS	6Gb/s SAS	64MB
	300GB	ST930005SS ²	6Gb/s SAS	64MB
	300GB	ST930006SS ²	6Gb/s SAS	64MB
	300GB	ST930006FC	6Gb/s SAS	64MB

ENTERPRISE STORAGE

Savvio 15k

The 2.5-inch Seagate Savvio 15k hard drive provides the world's highest performance and reliability while delivering ultra-low power consumption.



Key Advantages

- Stores twice the amount of Tier 1 data without increasing drive count
- Enables Tier 1 applications to process transactions more quickly
- Reduces system complexity and operating costs
- Self-Encrypting Drive (SED)² and FIPS 140-2 certified SED³ cut IT drive retirement costs and protect data. FIPS options meet government encryption compliance standards.

Best-Fit Applications

- High-performance enterprise servers and storage arrays
- Transaction-intensive database applications
- Blade, rack and tower servers
- Security compliance-driven IT organizations

	CAPACITY	MODEL	INTERFACE	CACHE
New	300GB	ST3000DM001	SATA 6Gb/s NQ	64MB
New	300GB	ST3000DM001	SATA 6Gb/s NQ	64MB
New	300GB	ST3000DM001	SATA 6Gb/s NQ	64MB
New	150GB	ST3000DM001	SATA 6Gb/s NQ	64MB
New	150GB	ST3000DM001	SATA 6Gb/s NQ	64MB
New	150GB	ST1500DM003	SATA 6Gb/s NQ	64MB
	150GB	ST1500DM003	SATA 6Gb/s NQ	64MB
	150GB	ST1500DM003	SATA 6Gb/s NQ	64MB
	75GB	ST750DM003	SATA 6Gb/s NQ	64MB
	75GB	ST750DM002	SATA 6Gb/s NQ	16MB
	75GB	ST320DM000	SATA 6Gb/s NQ	16MB
	75GB	ST250DM000	SATA 6Gb/s NQ	16MB

Cheetah 15k

The Seagate Cheetah 15k drive provides the highest capacity, performance and reliability in 3.5-inch mission-critical storage.



Key Advantages

- Third-generation perpendicular recording
- Sustained data rate of up to 204MB/s
- Industry's highest 3.5-inch drive reliability
- PowerTrim™ technology optimizes power consumption
- Self-Encrypting Drive (SED)² and FIPS 140-2 certified SED³ cut IT drive retirement costs and protect data. FIPS options meet government encryption compliance standards.

Best-Fit Applications

- Business and transaction processing
- Email and decision support
- Storage Area Networks (SAN)
- Network Attached Storage (NAS)
- Internet and e-commerce

	CAPACITY	MODEL	INTERFACE	CACHE
	300GB	ST3600067SS	6Gb/s SAS	16MB
	300GB	ST3600067SS ²	6Gb/s SAS	16MB
	300GB	ST3600067SS ²	6Gb/s SAS	16MB
	300GB	ST3600067FC	4Gb/s FC	16MB
	150GB	ST3450067SS	6Gb/s SAS	16MB
	150GB	ST3450067SS ²	6Gb/s SAS	16MB
	150GB	ST3450067FC	4Gb/s FC	16MB
	75GB	ST3300067SS	6Gb/s SAS	16MB
	75GB	ST3300067SS ²	6Gb/s SAS	16MB
	75GB	ST3300067FC	4Gb/s FC	16MB

INTERNAL STORAGE

Cheetah^{NS}

The Seagate Cheetah NS drive delivers the lowest-power, highest-reliability combination for 3.5-inch Tier 1 solutions.



Key Advantages

- Highest-capacity Tier 1 drive (600GB)
- Highest LFF reliability rating in the industry, with a 0.55% annualized failure rate (AFR)
- Seagate PowerTrim technology dynamically reduces power usage

Best-Fit Applications

- Mainstream enterprise applications
- Business and transaction processing
- Storage Area Networks (SAN)
- Network Attached Storage (NAS)

CAPACITY	MODEL	INTERFACE	CACHE
600GB	ST3600002SS	8Gb/s SAS	64MB
600GB	ST3600002PC	4Gb/s FC	64MB
450GB	ST3450602SS	8Gb/s SAS	64MB
450GB	ST3450602PC	4Gb/s FC	64MB
300GB	ST33000602PC	4Gb/s FC	64MB

Constellation^{ES.2}

The Seagate Constellation ES.2 drive offers the highest capacities with nearline performance, enterprise-class reliability, high data integrity and data security.



Key Advantages

- Highest-capacity enterprise drive for demanding data growth
- SAS and SATA drives designed for 24x7 reliability
- Best-in-class enhanced rotational vibration tolerance
- Self-Encrypting Drive (SED)² and FIPS 140-2 certified SED³ cut IT drive retirement costs and protect data. FIPS options meet government encryption compliance standards.

Best-Fit Applications

- High-capacity bulk-data storage
- Mainstream enterprise external storage arrays
- Enterprise backup and restore—D2D, virtual tape
- Centralized surveillance
- Cloud storage

	CAPACITY	MODEL	INTERFACE	CACHE
New	3TB	ST33000650NS	SATA 6Gb/s	64MB
New	3TB	ST33000651NS	SATA 6Gb/s	64MB
New	3TB	ST33000652NS ²	SATA 6Gb/s	64MB
New	2TB	ST33000650SS	8Gb/s SAS	64MB
New	2TB	ST33000651SS	8Gb/s SAS	64MB
New	2TB	ST33000652SS ²	8Gb/s SAS	64MB
New	2TB	ST33000649NS	SATA 6Gb/s	64MB
New	2TB	ST33000648NS	SATA 6Gb/s	64MB
New	2TB	ST33000647NS ²	SATA 6Gb/s	64MB
New	2TB	ST33000649SS	8Gb/s SAS	64MB
New	2TB	ST33000648SS	8Gb/s SAS	64MB
New	2TB	ST33000647SS ²	8Gb/s SAS	64MB

ENTERPRISE STORAGE

Constellation^{ES}

Seagate Constellation ES 3.5-inch hard drives offer the highest capacity at 2TB while providing enterprise robustness for seamless enterprise integration.



Key Advantages

- Enterprise nearline drive designed for 24x operation cut IT drive retirement costs and protect data. FIPS options
- Best-in-class rotational vibration tolerance
- Multi-drive firmware maximizes system availability
- Optimal power savings with PowerChoice[™] technology
- Self-Encrypting Drive (SED)² and FIPS 140-2 certified SED³ cut IT drive retirement costs and protect data. FIPS options meet government encryption compliance standards.

Best-Fit Applications

- High-capacity data center storage
- Mainstream enterprise external storage arrays
- Enterprise backup and restore
- Cloud storage

	CAPACITY	MODEL	INTERFACE	CACHE
New	2TB	ST2000NM0011	SATA 6Gb/s	64MB
New	2TB	ST2000NM003P ²	SATA 6Gb/s	64MB
New	2TB	ST2000NM005P ²	SATA 6Gb/s	64MB
New	2TB	ST2000NM0001	8Gb/s SAS	64MB
New	2TB	ST2000NM002P ²	8Gb/s SAS	64MB
New	2TB	ST2000NM004P ²	8Gb/s SAS	64MB
New	1TB	ST1000NM0011	SATA 6Gb/s	64MB
New	1TB	ST1000NM003P ²	SATA 6Gb/s	64MB
New	1TB	ST1000NM005P ²	SATA 6Gb/s	64MB
New	1TB	ST1000NM0001	8Gb/s SAS	64MB
New	1TB	ST1000NM002P ²	8Gb/s SAS	64MB
New	1TB	ST1000NM004P ²	8Gb/s SAS	64MB
New	500GB	ST500NM0011	SATA 6Gb/s	64MB
New	500GB	ST500NM003P ²	SATA 6Gb/s	64MB
New	500GB	ST500NM005P ²	SATA 6Gb/s	64MB
New	500GB	ST500NM0001	8Gb/s SAS	64MB
New	500GB	ST500NM002P ²	8Gb/s SAS	64MB
New	500GB	ST500NM004P ²	8Gb/s SAS	64MB

INTERNAL STORAGE

Constellation.2

The Seagate Constellation.2 drive is the only 2.5-inch enterprise-class hard drive delivering both 1TB capacities and enterprise reliability.



Key Advantages

- Maximizes data center footprint with up to 76TB/sq.ft.
- Energy-efficient storage at under 3.9W (idle)
- Highest nearline reliability with an MTBF of 1.4M hours
- Self-Encrypting Drive (SED)¹ and FIPS 140-2 certified SED² cut IT drive retirement costs and protect data. FIPS options meet government encryption compliance standards.

Best-Fit Applications

- Storage-hungry business applications
- Storage area networks and network attached storage
- Maximum-capacity servers and blade servers
- Rich media content storage
- Enterprise backup and restore—D2D, virtual tape
- Cloud computing

	CAPACITY	MODEL	INTERFACE	CACHE
	1TB	ST1000640US	SATA 6Gb/s	64MB
	1TB	ST1000641NS	SATA 6Gb/s	64MB
New	1TB	ST1000642NS ¹	SATA 6Gb/s	64MB
	1TB	ST1000640SS	6Gb/s SAS	64MB
	1TB	ST1000641SS	6Gb/s SAS	64MB
New	1TB	ST1000642SS ¹	6Gb/s SAS	64MB
	2TB	ST2000640NS	SATA 6Gb/s	64MB
	2TB	ST2000642NS ¹	SATA 6Gb/s	64MB
New	2TB	ST2000642SS ¹	6Gb/s SAS	64MB
	3TB	ST3000640SS	SATA 6Gb/s	64MB
	3TB	ST3000642SS ¹	6Gb/s SAS	64MB
	3TB	ST3000640NS	SATA 6Gb/s	64MB
	4TB	ST4000641NS	SATA 6Gb/s	64MB
	4TB	ST4000642NS ¹	SATA 6Gb/s	64MB

ENTERPRISE STORAGE

pulsar Xt.2

The Seagate Pulsar xT.2 SSD delivers the highest levels of performance, data integrity and drive endurance for the most demanding environments.



Key Advantages

- Consistent high performance for complex, I/O intensive, mixed workload enterprise environments
- Fastest random write performance available in a small form factor. SAS-based SSD
- Ultra-high endurance (supports over 35 full drive writes/day)
- Advanced media-management technology helps protect against unexpected data change or loss
- Self-Encrypting Drive (SED)² option (400GB only)

Best-Fit Applications

- Tier 0, external storage arrays
- Performance-hungry, write-intensive enterprise applications
- Blade servers, general servers and direct-attached storage
- Enterprise architectures that use auto-tiering solutions

FULL DRIVE			
CAPACITY	MODEL	INTERFACE	WRITES/DAY
400GB	ST400PM0002	6Gb/s SAS	35
400GB	ST400PM0012	6Gb/s SAS	35
200GB	ST200PM0002	6Gb/s SAS	35
100GB	ST100PM0002	6Gb/s SAS	35

pulsar.2

The Seagate Pulsar.2 drive delivers the price-performance, data integrity and endurance benefits needed by performance-hungry enterprise applications.



Key Advantages

- Best-in-class MLC endurance (up to 10 full drive writes/day)
- Price-performance and reliability benefits
- Protects against unintended data change or loss—ensuring data integrity
- Provides the same feature set to look, feel and act like an enterprise hard drive—reducing system complexity and operating costs

Best-Fit Applications

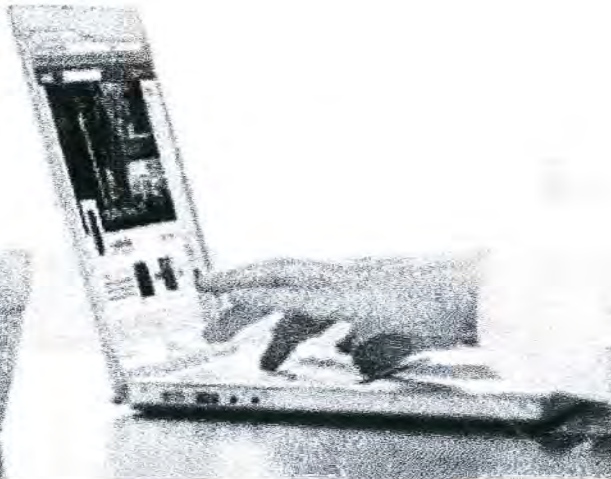
- Tier 0, performance-hungry enterprise applications—virtualization, OLTP, data warehousing and cloud computing
- Blade servers, general servers and direct-attached storage
- Enterprise architectures using auto-tiering

FULL DRIVE			
CAPACITY	MODEL	INTERFACE	WRITES/DAY
800GB	ST800PM0002	6Gb/s SAS	10
800GB	ST800PM0012 ¹	6Gb/s SAS	10
400GB	ST400PM0002	6Gb/s SAS	10
400GB	ST400PM0012	SATA 6Gb/s	10
200GB	ST200PM0002	6Gb/s SAS	10
200GB	ST200PM0012	SATA 6Gb/s	10
100GB	ST100PM0002	6Gb/s SAS	10
100GB	ST100PM0012	SATA 6Gb/s	10

Consumer Electronic Solutions

Storage solutions for DVRs and surveillance systems

Seagate has the global presence to provide the supply and support for CE integrators as well as a complete business and technology partnership for the entertainment electronics market.



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CONFIDENTIAL

CONSUMER ELECTRONIC

Product Comparison



	PIPELINE [®]	SV35 SERIES [®]
Application	Mainstream CE-DVR	Video Surveillance
Description	Cool, quiet, low-power performance—perfect for high-definition consumer DVR applications	Optimized performance, power savings and improved reliability for video surveillance applications
Form factor	3.5-inch	3.5-inch
Performance	Multi-room video delivery of at least ten simultaneous HD streams	7200 RPM
Reliability (A/R)	0.55%	<1%
Max. Ext. transfer rate	300MB/s to 600MB/s	600MB/s
Capacity	250GB to 2TB	1TB to 3TB
Interface	SATA 3Gb/s, SATA 6Gb/s	SATA 6Gb/s
Cache	8MB to 64MB	64MB
Power (idle)	2.5W to 4.5W	3.38W to 5.4W

Feature Comparison



	3.5-inch CE-DVR	Surveillance
Application	Pipeline HD	SV35 Series
SATA Interface	x	x
Low power	x	
Quiet Acoustics	x	
Cool operation	x	x
Sustainable technology	x	
best-in-Class performance	x	x
Capacity Leadership	x	
24x7 operation Capable	x	x
Extremely low vibration	x	

Use appropriate Seagate products for the intended application. All Seagate products are designed to meet or exceed industry standards.

storage solutions guide

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FED_SEAG0005099

INTERNAL STORAGE

pipeline hD

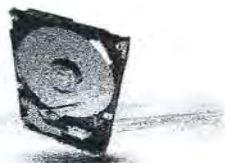
Seagate Pipeline HD drives deliver unprecedented levels of acoustic, power and vibration performance with room for hundreds of your favorite movies.

Key Advantages

- Virtually silent streaming performance as low as 19dB
- 75°C, 24-hour operation capable
- Operational power consumption as low as 3.4W
- 2.0A spin-up current limited

Best-Fit Applications

- Consumer digital video recorders
- Media servers and centers
- Home theater PCs and servers
- Cable, satellite and IPTV set-top boxes



CAPACITY	MODEL	INTERFACE	CACHE
1 TB	ST1000V200S	SATA 3Gb/s HDD	8MB
750GB	ST7500212CS	SATA 3Gb/s HDD	8MB
500GB	ST5000211CS	SATA 3Gb/s HDD	8MB
250GB	ST2500212CS	SATA 3Gb/s HDD	8MB

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Sv35 Series™

The Seagate Sv35 series drives optimize performance, save power and improve reliability for video surveillance applications.

Key Advantages

- Higher areal density for cost-effective DVR applications
- Performance-tuned for seamless video applications
- Enterprise-class reliability for 24x7 video surveillance applications
- Built-in error recovery for non-stop streaming

Best-Fit Applications

- Consumer digital video recorders
- Media servers and centers
- Home theater PCs and servers
- Cable, satellite and IPTV set-top boxes



CAPACITY	MODEL	INTERFACE	CACHE
5 TB	ST5000VX000	SATA 6Gb/s	64MB
2 TB	ST2000VX000	SATA 6Gb/s	64MB
1 TB	ST1000VX000	SATA 6Gb/s	64MB

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For Seagate reseller portal, visit <http://spp.seagate.com>

EXHIBIT 18



Product Manual

Seagate® Desktop HDD

Standard models

ST3000DM001
ST2000DM001
ST1500DM003
ST1000DM003
ST750DM003
ST500DM002
ST320DM000
ST250DM000

Self-Encryption models

ST3000DM002
ST2000DM002
ST1000DM004

Gen 14
100686584
Rev. L
January 2015

Document Revision History

Revision	Date	Description of Change
Rev. A	08/19/2011	Initial release.
Rev. B	09/01/2011	Updated decibel specifications, start/stop times; Table 3; mounting drawing.
Rev. C	10/20/2011	Updated voltage tolerance specifications.
Rev. D	01/17/2012	Corrected Table 1 (Altitude, operating) specification and Table 5 (Idle2).
Rev. E	06/11/2012	Updated Index.
Rev. F	09/05/2012	Added 2.5A spin-up code option (Table 1 and Table 2); page 17.
Rev. G	10/01/2012	Updated Table 1 and Table 2 with rated workload information. Updated DC power requirements (Tables 1, 3 and 4).
Rev. H	03/21/2014	Revised Rated Workload statement (pages 5 & 7); LP height updated & new mechanical drawings (pages 4, 9 & 20-21); Revised max storage note (page 13)
Rev. J	05/08/2014	Updated product name (pages fc, 2, 19 & 22) and Add metric "mm" values to mechanical drawings. (pages 20-21).
Rev. K	08/28/2014	Add SED models and SED Section 4.0 (pages: fc, 2, 4, 7, 22-23 & 29)
Rev. L	01/26/2015	Applied new logo (pages: fc & bc), applied latest page numbering convention (pages: all), added AFR = <1.0% & update Rated Workload text (pages: 9 & 11), added Case Temp note & changed "&" to "%" in Storage note (page: 17), add Reliability Section 2.12 (page: 20), cleaned up text in Mechanical Drawings (pages: 24-25) & revised SED section 4.0 (pages: 26-27).

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When referring to drive capacity, one gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes. Your computer's operating system may use a different standard of measurement and report a lower capacity. In addition, some of the listed capacity is used for formatting and other functions, and thus will not be available for data storage. Actual quantities will vary based on various factors, including file size, file format, features and application software. Actual data rates may vary depending on operating environment and other factors. The export or re-export of hardware or software containing encryption may be regulated by the U.S. Department of Commerce, Bureau of Industry and Security (for more information, visit www.bis.doc.gov), and controlled for import

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1.0 Introduction

This manual describes the functional, mechanical and interface specifications for the following:
Seagate® Desktop HDD model drives:

Standard models		Self-Encryption models
ST3000DM001	ST750DM003	ST3000DM002
ST2000DM001	ST500DM002	ST2000DM002
ST1500DM003	ST320DM000	ST1000DM004
ST1000DM003	ST250DM000	

Previous generations of Seagate Self-Encrypting Drive models were called Full Disk Encryption (FDE) models before a differentiation between drive-based encryption and other forms of encryption was necessary.

These drives provide the following key features:

- 7200 RPM spindle speed.
- High instantaneous (burst) data-transfer rates (up to 600MB per second).
- TGMR recording technology provides the drives with increased areal density.
- State-of-the-art cache and on-the-fly error-correction algorithms.
- Native Command Queuing with command ordering to increase performance in demanding applications.
- Full-track multiple-sector transfer capability without local processor intervention.
- Seagate AcuTrac™ servo technology delivers dependable performance, even with hard drive track widths of only 75 nanometers.
- Seagate OptiCache™ technology boosts overall performance by as much as 45% over the previous generation.
- Seagate SmartAlign™ technology provides a simple, transparent migration to Advanced Format 4K sectors.
- Quiet operation.
- Compliant with RoHS requirements in China and Europe.
- SeaTools diagnostic software performs a drive self-test that eliminates unnecessary drive returns.
- Support for S.M.A.R.T. drive monitoring and reporting.
- Supports latching SATA cables and connectors.
- Worldwide Name (WWN) capability uniquely identifies the drive.

1.1 About the SATA interface

The Serial ATA (SATA) interface provides several advantages over the traditional (parallel) ATA interface. The primary advantages include:

- Easy installation and configuration with true plug-and-play connectivity. It is not necessary to set any jumpers or other configuration options.
- Thinner and more flexible cabling for improved enclosure airflow and ease of installation.
- Scalability to higher performance levels.

In addition, SATA makes the transition from parallel ATA easy by providing legacy software support. SATA was designed to allow users to install a SATA host adapter and SATA disk drive in the current system and expect all of the existing applications to work as normal.

The SATA interface connects each disk drive in a point-to-point configuration with the SATA host adapter. There is no master/slave relationship with SATA devices like there is with parallel ATA. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both "masters" on two separate ports. This essentially means both drives behave as if they are Device 0 (master) devices.

The SATA host adapter and drive share the function of emulating parallel ATA device behavior to provide backward compatibility with existing host systems and software. The Command and Control Block registers, PIO and DMA data transfers, resets, and interrupts are all emulated.

The SATA host adapter contains a set of registers that shadow the contents of the traditional device registers, referred to as the Shadow Register Block. All SATA devices behave like Device 0 devices. For additional information about how SATA emulates parallel ATA, refer to the "Serial ATA International Organization: Serial ATA Revision 3.0". The specification can be downloaded from www.sata-io.org.

The host adapter may, optionally, emulate a master/slave environment to host software where two devices on separate SATA ports are represented to host software as a Device 0 (master) and Device 1 (slave) accessed at the same set of host bus addresses. A host adapter that emulates a master/slave environment manages two sets of shadow registers. This is not a typical SATA environment.

2.0 Drive Specifications

Unless otherwise noted, all specifications are measured under ambient conditions, at 25°C, and nominal power. For convenience, the phrases *the drive* and *this drive* are used throughout this manual to indicate the following drive models:

Standard models		Self-Encryption models
ST3000DM001	ST750DM003	ST3000DM002
ST2000DM001	ST500DM002	ST2000DM002
ST1500DM003	ST320DM000	ST1000DM004
ST1000DM003	ST250DM000	

2.1 Specification summary tables

The specifications listed in **Table 1** and **Table 2** are for quick reference. For details on specification measurement or definition, refer to the appropriate section of this manual.

Table 1 Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models

Drive Specification*	ST3000DM001 & ST3000DM002; ST2000DM001	ST2000DM001 & ST2000DM002; ST1500DM003	ST1000DM003 & ST1000DM004; ST750DM003
Formatted capacity (512 bytes/sector)**	3000GB (3TB); 2000GB (2TB)	2000GB (2TB); 1500GB (1.5TB)	1000GB (1TB); 750GB
Guaranteed sectors	5,860,533,168; 3,907,029,168	3,907,029,168; 2,930,277,168	1,953,525,168; 1,465,149,168
Heads	6	4	2
Disks	3	2	1
Bytes per sector (4K physical emulated at 512-byte sectors)	4096		
Default sectors per track	63		
Default read/write heads	16		
Default cylinders	16,383		
Recording density (max)	1807kFCI		
Track density (avg)	352ktracks/in		
Areal density (avg)	625Gb/in ²		
Spindle speed	7200 RPM		
Internal data transfer rate (max)	2147Mb/s		
Average data rate, read/write (MB/s)	156MB/s		
Maximum sustained data rate, OD read (MB/s)	210MB/s		
I/O data-transfer rate (max)	600MB/s		
Cache buffer	64MB		
Height (max)	26.1mm / 1.028 in		19.98mm / 0.787 in
Width (max)	101.6mm / 4.0 in (± 0.010 in)		101.6mm / 4.0 in (± 0.010 in)
Length (max)	146.99mm / 5.767 in		146.99mm / 5.767 in
Weight (typical)	626g / 1.38 lb	535g / 1.18 lb	400g / 0.88 lb
Average latency	4.16ms		
Power-on to ready (max)	<17.0s		<10.0s
Power-on to ready, 2.5A spin-up code option (typical)	<10.0s		n/a
Standby to ready (max)	<17.0s		<10.0s
Average seek, read (typical)	<8.5ms typical		
Average seek, write (typical)	<9.5ms typical		
Startup current 12V	2.0A or 2.8A		2.0A

Table 1 Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models (continued)

Drive Specification*	ST3000DM001 & ST3000DM002; ST2000DM001	ST2000DM001 & ST2000DM002; ST1500DM003	ST1000DM003 & ST1000DM004; ST750DM003
Voltage tolerance (including noise)	5V: $\pm 5\%$ 12V: $+10\%$ / -7.5%		
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)		
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)		
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)		
Relative humidity gradient (max)	30% per hour		
Wet bulb temperature (max)	37.7°C max (operating) 40.0°C max (non-operating)		
Altitude, operating	-304.8m to 3048m (-1000 ft to 10,000+ ft)		
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)		
Operational shock (max)	80 Gs at 2ms		
Non-operational shock (max)	300 Gs at 2ms		350 Gs at 2ms
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power Idle***	2.4 bels (typical) 2.6 bels (max)		2.2 bels (typical) 2.4 bels (max)
Seek	2.6 bels (typical) 2.7 bels (max)		2.4 bels (typical) 2.5 bels (max)
Non-recoverable read errors	1 per 10^{14} bits read		
Annualized Failure Rate (AFR)	<1.0% based on 2400 POH		
Maximum Rated workload	Maximum rate of <55TB/year Workloads exceeding the annualized rate may impact product reliability. The Annualized Workload Rate is in units of TB per year, or TB per 2400 power on hours. Workload Rate = TB transferred * (2400 / recorded power on hours).		
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: http://www.seagate.com/support/warranty-and-replacements/ . From this page, click on "Check to see if the drive is under Warranty". Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.		
Load/Unload cycles (25°C, 50% rel. humidity)	300,000		
Supports Hotplug operation per the Serial ATA Revision 3.2 specification	Yes		

*All specifications above are based on native configurations.

** One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

*** During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

Table 2 Drive specifications summary for 500GB, 320GB and 250GB models

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Formatted capacity**	500GB	320GB	250GB
Guaranteed sectors	976,773,168	625,142,448	488,397,168
Heads	2		1
Disks	1		
Bytes per sector (4K physical emulated at 512-byte sectors)	4096		
Default sectors per track	63		
Default read/write heads	16		
Default cylinders	16,383		
Recording density (max)	1413kb/in		
Track density (avg)	236ktracks/in		
Areal density (avg)	329Gb/in ²		
Spindle speed	7200 RPM		
Internal data transfer rate (max)	1695Mb/s		
Average Data Rate, read/write (MB/s)	125MB/s		
Maximum sustained data transfer rate, OD read	144MB/s		
I/O data-transfer rate (max.)	600MB/s		
Cache buffer	16MB		
Height (max)	19.98mm / 0.787 in		
Width (max)	101.6mm / 4.0 in (+ 0.010 in)		
Length (max)	146.99mm / 5.787 in		
Weight (typical)	415g / 0.915 lb		
Average latency	4.16ms		
Power-on to ready (max)	<8.5s		
Standby to ready (max)	<8.5s		
Average seek, read (typical)	<8.5ms (read)		
Average seek, write (typical)	<9.5ms (write)		
Startup current (typical) 12V	2.0A		
Voltage tolerance (including noise)	5V: ±5% 12V: +10% / -7.5%		
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)		
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)		
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)		
Relative humidity gradient (max)	30% per hour		
Wet bulb temperature (max)	37.7°C (operating) 40.0°C (non-operating)		
Altitude, operating	-304.8m to 3048m (-1000 ft to 10,000+ ft)		
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)		
Operational shock (max)	70 Gs at 2ms		
Non-operational shock (max)	350 Gs at 2ms		
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power			

Table 2 Drive specifications summary for 500GB, 320GB and 250GB models (continued)

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Idle***		2.2 bels (typical) 2.3 bels (max)	
Seek		2.3 bels (typical) 2.4 bels (max)	
Non-recoverable read errors	1 per 10 ¹⁴ bits read		
Annualized Failure Rate (AFR)	<1.0% based on 2400 POH		
Maximum Rated workload	Maximum rate of <55TB/year Workloads exceeding the annualized rate may impact product reliability. The Annualized Workload Rate is in units of TB per year, or TB per 2400 power on hours. Workload Rate = TB transferred * (2400 / recorded power on hours).		
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: http://www.seagate.com/support/warranty-and-replacements/ . From this page, click on "Check to see if the drive is under Warranty". Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.		
Contact start-stop cycles	50,000 at 25°C, 50% rel. humidity		
Supports Hotplug operation per the Serial ATA Revision 3.2 specification	Yes		

* All specifications above are based on native configurations.

** One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

*** During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

2.2 Formatted capacity

Model	Formatted capacity*	Guaranteed sectors	Bytes per sector
ST3000DM001 ST3000DM002	3000GB	5,860,533,168	4K
ST2000DM001 ST2000DM002	2000GB	3,907,029,168	
ST1500DM003	1500GB	2,930,277,168	
ST1000DM003 ST1000DM004	1000GB	1,953,525,168	
ST750DM003	750GB	1,465,149,168	
ST500DM002	500GB	976,773,168	
ST320DM000	320GB	625,142,448	
ST250DM000	250GB	488,397,168	

*One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

2.2.1 LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to $n-1$, where n is the number of guaranteed sectors as defined above.

See Section 5.3.1, "Identify Device command" (words 60-61 and 100-103) for additional information about 48-bit addressing support of drives with capacities over 137GB.

2.3 Default logical geometry

Cylinders: 16,383

Read/write heads: 16

Sectors per track: 63

LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to $n-1$, where n is the number of guaranteed sectors as defined above.

2.4 Recording and interface technology

Interface	SATA
Recording method	TGMR
Recording density (kFCI)	
3TB, 2TB, 1.5TB, 1TB and 750GB models	1807
500GB, 320GB and 250GB models	1413
Track density (ktracks/inch avg)	352
Areal density (Gb/in ²)	
3TB, 2TB, 1.5TB, 1TB and 750GB models	625
500GB, 320GB, 250GB models	329
Spindle speed (RPM)	7200 ± 0.2%
Internal data transfer rate (Mb/s max)	2147
Maximum sustained data transfer rate, OD read (MB/s)	
3TB, 2TB, 1.5TB, 1TB and 750GB models	210
500GB, 320GB, 250GB models	144
Average data rate, read/write (MB/s)	
3TB, 2TB, 1.5TB, 1TB and 750GB models	156
500GB, 320GB, 250GB models	125
I/O data-transfer rate (MB/s max)	600

2.5 Physical characteristics

Maximum height	
3TB, 2TB and 1.5TB	26.1mm / 1.028 in
1TB, 750GB, 500GB, 320GB, 250GB	19.98mm / 0.787 in
Maximum width (all models)	101.6mm / 4.0 in (± 0.010 in)
Maximum length (all models)	146.99mm / 5.787 in
Typical weight	
3TB and 2TB	626g / 1.38 lb
1.5TB	535g / 1.18 lb
1TB and 750GB	400g / 0.88 lb
500GB, 320GB, 250GB	415g / 0.92 lb
Cache buffer	
3TB, 2TB, 1.5TB, 1TB, 750GB	64MB (64,768kb)
500GB, 320GB and 250GB	16MB (16,384kb)

2.6 Seek time

Seek measurements are taken with nominal power at 25°C ambient temperature. All times are measured using drive diagnostics. The specifications in the table below are defined as follows:

Track-to-track seek time is an average of all possible single-track seeks in both directions.

Average seek time is a true statistical random average of at least 5000 measurements of seeks between random tracks, less overhead.

Typical seek times (ms)	Read	Write
Track-to-track	1.0	1.2
Average	8.5	9.5
Average latency	4.16	

These drives are designed to consistently meet the seek times represented in this manual. Physical seeks, regardless of mode (such as track-to-track and average), are expected to meet the noted values. However, due to the manner in which these drives are formatted, benchmark tests that include command overhead or measure logical seeks may produce results that vary from these specifications.

2.7 Start/stop times

	3-disk (3TB, 2TB models)	2-disk (2TB, 1.5TB models)	1-disk (1TB, 750GB models)	1-disk (250GB, 320GB, 500GB models)
Power-on to ready (in seconds)	15 (typical) 17 (max)		10 (typical) 12 (max)	8.5 (typical) 10 (max)
Power-on to ready, 2.5A spin-up code option (in seconds, typical)	<10		n/a	
Standby to ready (in seconds)	15 (typical) 17 (max)		10 (typical) 12 (max)	8.5 (typical) 10 (max)
Ready to spindle stop (in seconds)	10 (typical) 11 (max)		10 (typical) 11 (max)	

Time-to-ready may be longer than normal if the drive power is removed without going through normal OS powerdown procedures.

2.8 Power specifications

The drive receives DC power (+5V or +12V) through a native SATA power connector. Refer to **Figure 1 on page 23**.

2.8.1 Power consumption

Power requirements for the drives are listed in **Table 3**, **Table 4**, **Table 5** and **Table 6**. Typical power measurements are based on an average of drives tested, under nominal conditions, using 5.0V and 12.0V input voltage at 25°C ambient temperature.

Spinup power

Spinup power is measured from the time of power-on to the time that the drive spindle reaches operating speed.

Read/write power and current

Read/write power is measured with the heads on track, based on a 16-sector write followed by a 32-ms delay, then a 16-sector read followed by a 32-ms delay.

Operating power and current

Operating power is measured using 40 percent random seeks, 40 percent read/write mode (1 write for each 10 reads) and 20 percent drive idle mode.

Idle mode power

Idle mode power is measured with the drive up to speed, with servo electronics active and with the heads in a random track location.

Standby mode

During Standby mode, the drive accepts commands, but the drive is not spinning, and the servo and read/write electronics are in power-down mode.

Table 3 DC power requirements (3-disk: 3TB and 2TB models)

Power dissipation (3-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0A or 2.8A
Idle2* †	5.40	0.190	0.377
Operating	8.00	0.510	0.462
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

Table 4 DC power requirements (2-disk: 2TB and 1.5TB models)

Power dissipation (2-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0A or 2.8A
Idle2* †	4.50	0.196	0.296
Operating	6.70	0.525	0.340
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

Table 5 DC power requirements (1-disk: 1TB and 750GB models)

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0
Idle2* †	3.36	0.152	0.216
Operating	5.90	0.500	0.329
Standby	0.63	0.111	0.006
Sleep	0.63	0.111	0.006

Table 6 DC power requirements (1-disk: 500, 320 and 250GB models)

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0
Perf Idle* †	4.60	0.378	0.224
Operating	6.19	0.656	0.243
Standby	0.79	0.350	0.010
Sleep	0.79	0.350	0.010

*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

†5W IDLE with DIPLM Enabled

2.8.2 Conducted noise

Input noise ripple is measured at the host system power supply across an equivalent 80-ohm resistive load on the +12 volt line or an equivalent 15-ohm resistive load on the +5 volt line.

Using 12-volt power, the drive is expected to operate with a maximum of 120 mV peak-to-peak square-wave injected noise at up to 10MHz.

Using 5-volt power, the drive is expected to operate with a maximum of 100 mV peak-to-peak square-wave injected noise at up to 10MHz.

Equivalent resistance is calculated by dividing the nominal voltage by the typical RMS read/write current.

2.8.3 Voltage tolerance

Voltage tolerance (including noise):

5V $\pm 5\%$

12V $+10\%$ / -7.5%

2.8.4 Power-management modes

The drive provides programmable power management to provide greater energy efficiency. In most systems, users can control power management through the system setup program. The drive features the following power-management modes:

Power modes	Heads	Spindle	Buffer
Active	Tracking	Rotating	Enabled
Idle	Tracking	Rotating	Enabled
Standby	Parked	Stopped	Enabled
Sleep	Parked	Stopped	Disabled

Active mode

The drive is in Active mode during the read/write and seek operations.

Idle mode

The buffer remains enabled, and the drive accepts all commands and returns to Active mode any time disk access is necessary.

Standby mode

The drive enters Standby mode when the host sends a Standby Immediate command. If the host has set the standby timer, the drive can also enter Standby mode automatically after the drive has been inactive for a specifiable length of time. The standby timer delay is established using a Standby or Idle command. In Standby mode, the drive buffer is enabled, the heads are parked and the spindle is at rest. The drive accepts all commands and returns to Active mode any time disk access is necessary.

Sleep mode

The drive enters Sleep mode after receiving a Sleep command from the host. In Sleep mode, the drive buffer is disabled, the heads are parked and the spindle is at rest. The drive leaves Sleep mode after it receives a Hard Reset or Soft Reset from the host. After receiving a reset, the drive exits Sleep mode and enters Standby mode with all current translation parameters intact.

Idle and Standby timers

Each time the drive performs an Active function (read, write or seek), the standby timer is reinitialized and begins counting down from its specified delay times to zero. If the standby timer reaches zero before any drive activity is required, the drive makes a transition to Standby mode. In both Idle and Standby mode, the drive accepts all commands and returns to Active mode when disk access is necessary.

2.9 Environmental specifications

This section provides the temperature, humidity, shock, and vibration specifications. Ambient temperature is defined as the temperature of the environment immediately surrounding the drive. Above 1000ft. (305 meters), the maximum temperature is derated linearly by 1°C every 1000 ft.

The maximum allowable drive case temperature is 60°C.
See Figures 2 & 3 for HDA case temperature measurement locations.

Refer to Section 3.4 Drive mounting for base plate measurement location.

2.9.1 Ambient temperature

Operating	0° to 60°C (32° to 140°F)
Non-operating	–40° to 70°C (–40° to 158°F)

2.9.2 Temperature gradient

Operating	20°C per hour (68°F per hour max), without condensation
Non-operating	30°C per hour (86°F per hour max)

2.9.3 Humidity

2.9.3.1 Relative humidity

Operating	5% to 95% non-condensing (30% per hour max)
Nonoperating	5% to 95% non-condensing (30% per hour max)

2.9.3.2 Wet bulb temperature

Operating	37.7°C (99.9°F max)
Non-operating	40°C (104°F max)

2.9.4 Altitude

Operating	–304.8m to 3048m (–1000 ft. to 10,000+ ft.)
Non-operating	–304.8m to 12,192m (–1000 ft. to 40,000+ ft.)

Maximum storage condition not to exceed 90 days at a wetbulb temperature of 32°C (example: 34°C / 90% RH)

2.9.5 Shock

All shock specifications assume that the drive is mounted securely with the input shock applied at the drive mounting screws. Shock may be applied in the X, Y or Z axis.

2.9.5.1 Operating shock

These drives comply with the performance levels specified in this document when subjected to a maximum operating shock of 80 Gs based on half-sine shock pulses of 2 ms during read operations. Shocks should not be repeated more than two times per second.

2.9.5.2 Non-operating shock

3TB, 2TB and 1.5TB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 300 Gs based on a non-repetitive half-sine shock pulse of 2 ms duration.

1TB, 750GB, 500GB, 320GB and 250GB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 350 Gs based on a non-repetitive half-sine shock pulse of 2-ms duration.

2.9.5.3 Operating vibration

The maximum vibration levels that the drive may experience while meeting the performance standards specified in this document are specified below.

2Hz to 22Hz	0.25 Gs (Limited displacement)
22Hz to 350Hz	0.50 Gs
350Hz to 500Hz	0.25 Gs

All vibration specifications assume that the drive is mounted securely with the input vibration applied at the drive mounting screws. Vibration may be applied in the X, Y or Z axis. Throughput may vary if improperly mounted.

2.9.6 Non-operating vibration

The maximum non-operating vibration levels that the drive may experience without incurring physical damage or degradation in performance when subsequently put into operation are specified below.

5Hz to 22Hz	3.0 Gs (Limited displacement)
22Hz to 350Hz	3.0 Gs
350Hz to 500Hz	3.0 Gs

2.10 Acoustics

Drive acoustics are measured as overall A-weighted acoustic sound power levels (no pure tones). All measurements are consistent with ISO document 7779. Sound power measurements are taken under essentially free-field conditions over a reflecting plane. For all tests, the drive is oriented with the cover facing upward.

For seek mode tests, the drive is placed in seek mode only. The number of seeks per second is defined by the following equation:

$$(\text{Number of seeks per second} = 0.4 / (\text{average latency} + \text{average access time}))$$

Table 7 Fluid Dynamic Bearing (FDB) motor acoustics

	Idle*	Seek
3 Disks (3TB, 2TB)	2.4 bels (typical) 2.6 bels (max)	2.6 bels (typical) 2.7 bels (max)
2 Disks (2TB, 1.5TB)		
1 Disk (1TB, 750GB)	2.2 bels (typical) 2.3 bels (max)	2.3 bels (typical) 2.4 bels (max)
1 Disk (500GB, 320GB, 250GB)	2.2 bels (typical) 2.4 bels (max)	2.4 bels (typical) 2.5 bels (max)

*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

2.10.1 Test for Prominent Discrete Tones (PDTs)

Seagate follows the ECMA-74 standards for measurement and identification of PDTs. An exception to this process is the use of the absolute threshold of hearing. Seagate uses this threshold curve (originated in ISO 389-7) to discern tone audibility and to compensate for the inaudible components of sound prior to computation of tone ratios according to Annex D of the ECMA-74 standards.

2.11 Electromagnetic immunity

When properly installed in a representative host system, the drive operates without errors or degradation in performance when subjected to the radio frequency (RF) environments defined in **Table 8**.

Table 8 Radio frequency environments

Test	Description	Performance level	Reference standard
Electrostatic discharge	Contact, HCP, VCP: ± 4 kV; Air: ± 8 kV	B	EN61000-4-2: 95
Radiated RF immunity	80MHz to 1,000MHz, 3 V/m, 80% AM with 1kHz sine 900MHz, 3 V/m, 50% pulse modulation @ 200Hz	A	EN61000-4-3: 96 ENV50204: 95
Electrical fast transient	± 1 kV on AC mains, ± 0.5 kV on external I/O	B	EN61000-4-4: 95
Surge immunity	± 1 kV differential, ± 2 kV common, AC mains	B	EN61000-4-5: 95
Conducted RF immunity	150kHz to 80MHz, 3 Vrms, 80% AM with 1kHz sine	A	EN61000-4-6: 97
Voltage dips, interrupts	0% open, 5 seconds 0% short, 5 seconds 40%, 0.10 seconds 70%, 0.01 seconds	C C C B	EN61000-4-11: 94

2.12 Reliability

2.12.1 Annualized Failure Rate (AFR)

The production disk drive shall achieve an annualized failure-rate of <1.0% over a 5 year service life when used in Desktop Storage field conditions as limited by the following:

- 2400 power-on-hours per year.
- Typical workload

Nonrecoverable read errors	1 per 10 ¹⁴ bits read, max
Maximum Rated Workload	Maximum rate of <55TB/year Workloads exceeding the annualized rate may impact product reliability. The Annualized Workload Rate is in units of TB per year, or TB per 2400 power on hours. Workload Rate = TB transferred * (2400 / recorded power on hours).
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: http://www.seagate.com/support/warranty-and-replacements/ . From this page, click on the "Check to see if the drive is under Warranty" link. The following are required to be provided: the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.
Preventive maintenance	None required.

2.13 Warranty

To determine the warranty for a specific drive, use a web browser to access the following web page: <http://www.seagate.com/support/warranty-and-replacements/>

From this page, click on "Check to see if the drive is under Warranty". Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.

2.14 Agency certification

2.14.1 Safety certification

These products are certified to meet the requirements of UL60950-1, CSA60950-1 and EN60950 and so marked as to the certify agency.

2.14.2 Electromagnetic compatibility

Hard drives that display the CE mark comply with the European Union (EU) requirements specified in the Electromagnetic Compatibility Directive (2004/108/EC) as put into place 20 July 2007. Testing is performed to the levels specified by the product standards for Information Technology Equipment (ITE). Emission levels are defined by EN 55022, Class B and the immunity levels are defined by EN 55024.

Drives are tested in representative end-user systems. Although CE-marked Seagate drives comply with the directives when used in the test systems, we cannot guarantee that all systems will comply with the directives. The drive is designed for operation inside a properly designed enclosure, with properly shielded I/O cable (if necessary) and terminators on all unused I/O ports. Computer manufacturers and system integrators should confirm EMC compliance and provide CE marking for their products.

Korean RRL

If these drives have the Korean Communications Commission (KCC) logo, they comply with paragraph 1 of Article 11 of the Electromagnetic Compatibility control Regulation and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Radio Research Laboratory (RRL) Communications Commission, Republic of Korea.

These drives have been tested and comply with the Electromagnetic Interference/Electromagnetic Susceptibility (EMI/EMS) for Class B products. Drives are tested in a representative, end-user system by a Korean-recognized lab.

Family name: Barracuda

Certificate number: KCC-REM-STX-Barracuda

Australian C-Tick (N176)

If these models have the C-Tick marking, they comply with the Australia/New Zealand Standard AS/NZ CISPR22 and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Australian Communication Authority (ACA).

2.14.3 FCC verification

These drives are intended to be contained solely within a personal computer or similar enclosure (not attached as an external device). As such, each drive is considered to be a subassembly even when it is individually marketed to the customer. As a subassembly, no Federal Communications Commission verification or certification of the device is required.

Seagate has tested this device in enclosures as described above to ensure that the total assembly (enclosure, disk drive, motherboard, power supply, etc.) does comply with the limits for a Class B computing device, pursuant to Subpart J, Part 15 of the FCC rules. Operation with non-certified assemblies is likely to result in interference to radio and television reception.

Radio and television interference. This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception.

This equipment is designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television, which can be determined by turning the equipment on and off, users are encouraged to try one or more of the following corrective measures:

Reorient the receiving antenna.

Move the device to one side or the other of the radio or TV.

Move the device farther away from the radio or TV.

Plug the computer into a different outlet so that the receiver and computer are on different branch outlets.

If necessary, users should consult the dealer or an experienced radio/television technician for additional suggestions. Users may find helpful the following booklet prepared by the Federal Communications Commission: *How to Identify and Resolve Radio-Television Interference Problems*. This booklet is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Refer to publication number 004-000-00345-4.

2.15 Environmental protection

Seagate designs its products to meet environmental protection requirements worldwide, including regulations restricting certain chemical substances.

2.15.1 European Union Restriction of Hazardous Substances (RoHS) Directive

The European Union Restriction of Hazardous Substances (RoHS) Directive, restricts the presence of chemical substances, including Lead, Cadmium, Mercury, Hexavalent Chromium, PBB and PBDE, in electronic products, effective July 2006. This drive is manufactured with components and materials that comply with the RoHS Directive.

2.15.2 China Restriction of Hazardous Substances (RoHS) Directive 中国限制危险物品的指令

This product has an Environmental Protection Use Period (EPUP) of 20 years. The following table contains information mandated by China's "Marking Requirements for Control of Pollution Caused by Electronic Information Products" Standard.



该产品具有20年的环境保护使用周期（EPUP）。下表包含了中国“电子产品所导致的污染的控制的记号要求”所指定的信息。

Name of Parts 部件名称	Toxic or Hazardous Substances or Elements 有毒有害物质或元素					
	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 镉 (Cd)	Hexavalent Chromium 六价铬 (Cr6+)	Polybrominated Diphenyl 多溴联苯 (PBB)	Polybrominated Diphenyl Ether 多溴二苯醚 (PBDE)
PCBA	X	O	O	O	O	O
HDA	X	O	O	O	O	O

"O" indicates the hazardous and toxic substance content of the part (at the homogeneous material level) is lower than the threshold defined by the China RoHS MCV Standard.

“O”表示该部件（于同类物品程度上）所含的危险和有毒物质低于中国RoHS MCV标准所定义的门槛值。

"X" indicates the hazardous and toxic substance content of the part (at the homogeneous material level) is over the threshold defined by the China RoHS MCV Standard.

“X”表示该部件（于同类物品程度上）所含的危险和有毒物质超出中国RoHS MCV标准所定义的门槛值。

2.16 Corrosive environment

Seagate electronic drive components pass accelerated corrosion testing equivalent to 10 years exposure to light industrial environments containing sulfurous gases, chlorine and nitric oxide, classes G and H per ASTM B845. However, this accelerated testing cannot duplicate every potential application environment. Users should use caution exposing any electronic components to uncontrolled chemical pollutants and corrosive chemicals as electronic drive component reliability can be affected by the installation environment. The silver, copper, nickel and gold films used in Seagate products are especially sensitive to the presence of sulfide, chloride, and nitrate contaminants. Sulfur is found to be the most damaging. In addition, electronic components should never be exposed to condensing water on the surface of the printed circuit board assembly (PCBA) or exposed to an ambient relative humidity greater than 95%. Materials used in cabinet fabrication, such as vulcanized rubber, that can outgas corrosive compounds should be minimized or eliminated. The useful life of any electronic equipment may be extended by replacing materials near circuitry with sulfide-free alternatives.

3.0 Configuring and Mounting the Drive

This section contains the specifications and instructions for configuring and mounting the drive.

3.1 Handling and static-discharge precautions

After unpacking, and before installation, the drive may be exposed to potential handling and electrostatic discharge (ESD) hazards. Observe the following standard handling and static-discharge precautions:

Caution

Before handling the drive, put on a grounded wrist strap, or ground oneself frequently by touching the metal chassis of a computer that is plugged into a grounded outlet. Wear a grounded wrist strap throughout the entire installation procedure.

Handle the drive by its edges or frame *only*.

The drive is extremely fragile—handle it with care. Do not press down on the drive top cover.

Always rest the drive on a padded, antistatic surface until mounting it in the computer.

Do not touch the connector pins or the printed circuit board.

Do not remove the factory-installed labels from the drive or cover them with additional labels. Removal voids the warranty. Some factory-installed labels contain information needed to service the drive. Other labels are used to seal out dirt and contamination.

3.2 Configuring the drive

Each drive on the SATA interface connects point-to-point with the SATA host adapter. There is no master/slave relationship because each drive is considered a master in a point-to-point relationship. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. Both drives behave as if they are Device 0 (master) devices.

SATA drives are designed for easy installation. It is usually not necessary to set any jumpers on the drive for proper operation; however, if users connect the drive and receive a “drive not detected” error, the SATA-equipped motherboard or host adapter may use a chipset that does not support SATA speed autonegotiation.

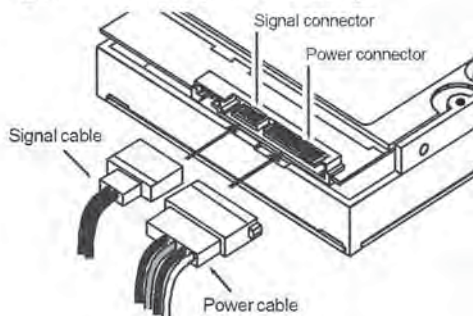
3.3 SATA cables and connectors

The SATA interface cable consists of four conductors in two differential pairs, plus three ground connections. The cable size may be 30 to 26 AWG with a maximum length of one meter (39.37 inches). See Table 9 for connector pin definitions. Either end of the SATA signal cable can be attached to the drive or host.

For direct backplane connection, the drive connectors are inserted directly into the host receptacle. The drive and the host receptacle incorporate features that enable the direct connection to be hot pluggable and blind mateable.

For installations which require cables, users can connect the drive as illustrated in Figure 1.

Figure 1 Attaching SATA cabling



Each cable is keyed to ensure correct orientation. Desktop HDD drives support latching SATA connectors.

3.4 Drive mounting

Users can mount the drive in any orientation using four screws in the side-mounting holes or four screws in the bottom-mounting holes. Refer to **Figure 2** and **Figure 3** for drive mounting dimensions. Follow these important mounting precautions when mounting the drive:

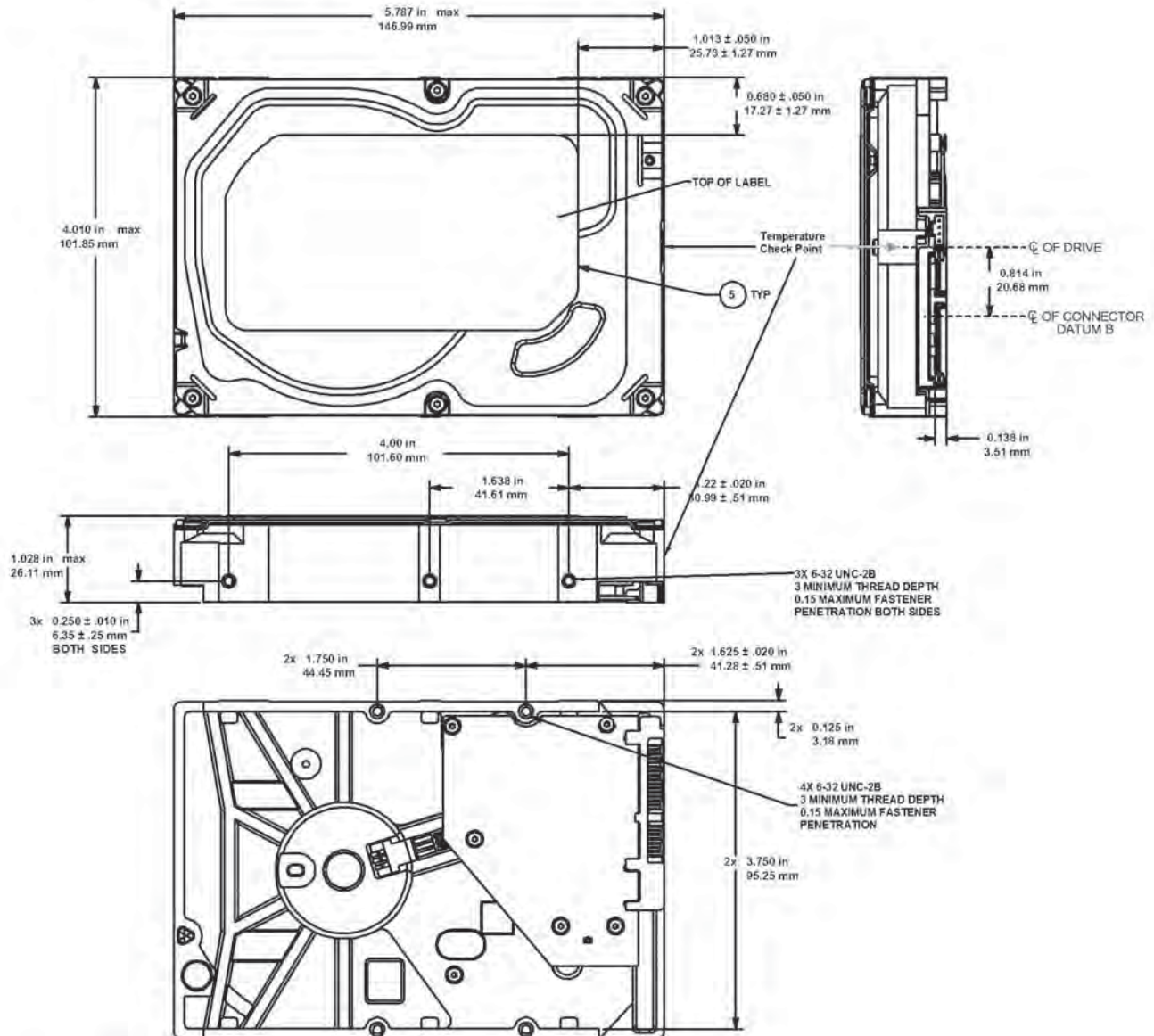
Allow a minimum clearance of 0.030 inches (0.76mm) around the entire perimeter of the drive for cooling.

Use only 6-32 UNC mounting screws.

The screws should be inserted no more than 0.150 inch (3.81mm) into the bottom or side mounting holes.

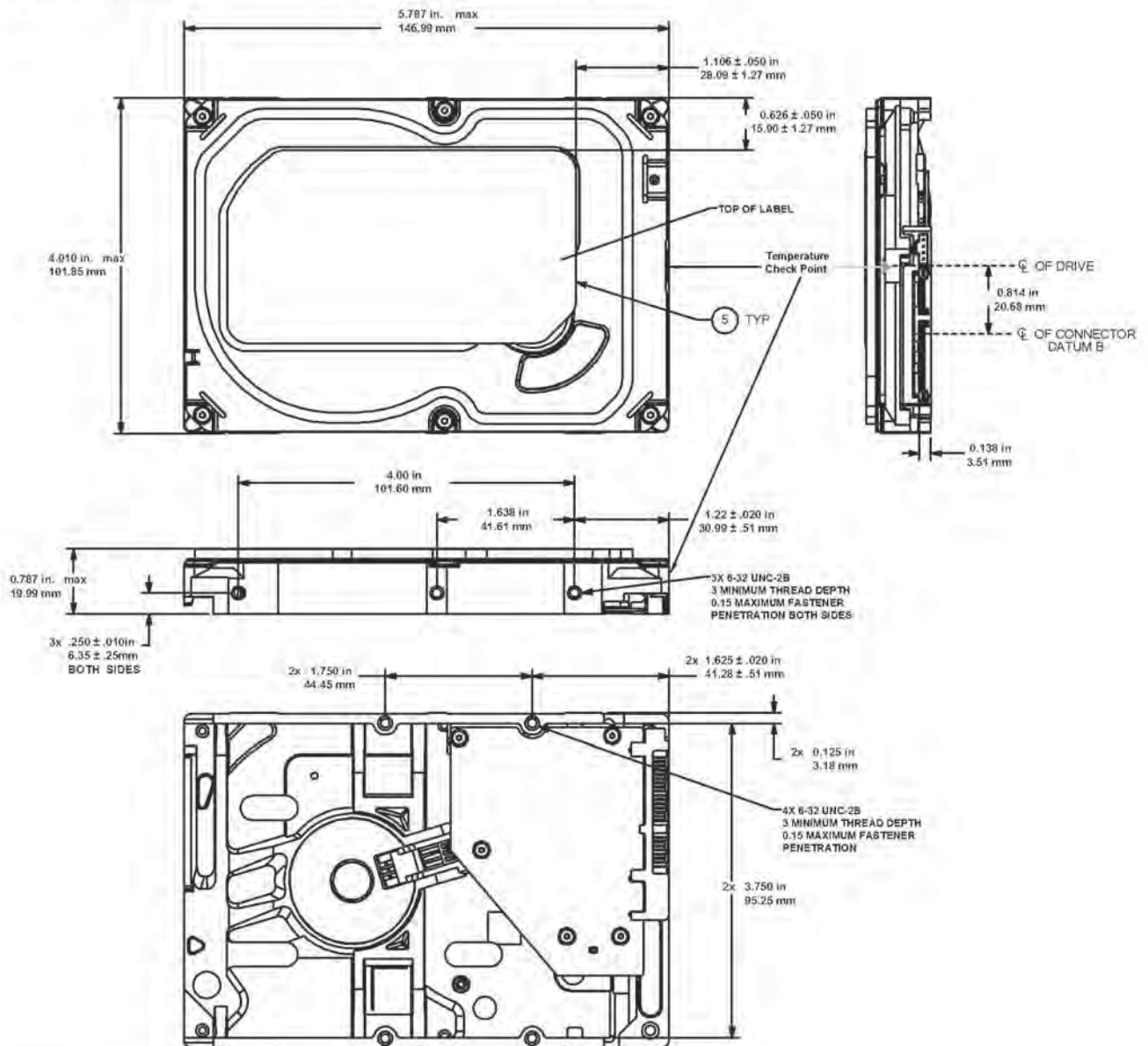
Do not overtighten the mounting screws (maximum torque: 6 inch-lb).

Figure 2 Mounting dimensions (3-disk; 1.5TB to 3TB models)



Drawings are for mounting hole reference only.
PCBA show in pictorial only and can vary based on specific customer configurations.

Figure 3 Mounting dimensions (1-disk: 250GB to 1TB models)



Drawings are for mounting hole reference only.
PCBA show in pictorial only and can vary based on specific customer configurations.

4.0 About (SED) Self-Encrypting Drives

Self-encrypting drives (SEDs) offer encryption and security services for the protection of stored data, commonly known as "data at rest". These drives are compliant with the Trusted Computing Group (TCG) Opal Storage Specifications as detailed in the following:

TCG Storage Architecture Core Specification, Version 2.0 (see www.trustedcomputinggroup.org)

TCG Storage Security Subsystem Class Opal Specification, Version 2.0 (see www.trustedcomputinggroup.org)

In case of conflict between this document and any referenced document, this document takes precedence.

The Trusted Computing Group (TCG) is a standards organization sponsored and operated by companies in the computer, storage and digital communications industry. Seagate's SED models comply with the standards published by the TCG.

To use the security features in the drive, the host must be capable of constructing and issuing the following two SATA commands:

Trusted Send

Trusted Receive

These commands are used to convey the TCG protocol to and from the drive in their command payloads. Seagate Secure SEDs also support TCG Single User Mode, which can be disabled.

4.1 Data Encryption

Encrypting drives use one inline encryption engine within each drive employing AES-256 algorithms in Cipher Block Chaining (CBC) mode to encrypt all data prior to being written on the media and to decrypt all data as it is read from the media. The encryption engine is always in operation and cannot be disabled. The 32-byte Data Encryption Key (DEK) is a random number which is generated by the drive, never leaves the drive, and is inaccessible to the host system. The DEK is itself encrypted when it is stored on the media and when in volatile temporary storage (DRAM), which is external to the encryption engine. A unique data encryption key is used for each of the drive's possible 16 data bands (see **Section 4.5 Data Bands**).

4.2 Controlled Access

The drive has two security providers (SPs) called the "Admin SP" and the "Locking SP." These act as gatekeepers to the drive security services. Security-related commands will not be accepted unless the user provides the correct credentials to prove that they are authorized to perform the command.

4.2.1 Admin SP

The Admin SP allows the drive's owner to enable or disable firmware download operations (see **Section 4.4 Drive Locking**). Access to the Admin SP is available using the SID (Secure ID) password.

4.2.2 Locking SP

The Locking SP controls read/write access to the media and the cryptographic erase feature. Access to the Locking SP is available using the Admin or User passwords.

4.2.3 Default password

When the drive is shipped from the factory, all passwords are set to the value of MSID. This 32-byte random value can only be read by the host electronically over the interface. After receipt of the drive, it is the responsibility of the owner to use the default MSID password as the authority to change all other passwords to unique owner-specified values.

4.2.4 ATA Enhanced Security

The drive can utilize the system's BIOS through the ATA Security API for cases that do not require password management and additional security policies.

Furthermore, the drive's ATA Security Erase Unit command shall support both Normal and Enhanced Erase modes with the following modifications/additions:

Normal Erase: Normal erase feature shall be performed by changing the Data Encryption Key (DEK) of the drive, followed by an overwrite operation that repeatedly writes a single sector containing random data to the entire drive. This write operation bypasses the media encryption. On reading back the overwritten sectors, the host will receive a decrypted version, using the new DEK of the random data sector (the returned data will not match what was written).

Enhanced Erase: Enhanced erase shall be performed by changing the Data Encryption Key of the drive.

4.3 Random Number Generator (RNG)

The drive has a 32-byte hardware RNG that it is uses to derive encryption keys or, if requested to do so, to provide random numbers to the host for system use, including using these numbers as Authentication Keys (passwords) for the drive's Admin and Locking SPs.

4.4 Drive Locking

In addition to changing the passwords, as described in **Section 4.2.3 Default password**, the owner should also set the data access controls for the individual bands.

The variable "LockOnReset" should be set to "PowerCycle" to ensure that the data bands will be locked if power is lost. In addition "ReadLockEnabled" and "WriteLockEnabled" must be set to true in the locking table in order for the bands "LockOnReset" setting of "PowerCycle" to actually lock access to the band when a "PowerCycle" event occurs. This scenario occurs if the drive is removed from its cabinet. The drive will not honor any data read or write requests until the bands have been unlocked. This prevents the user data from being accessed without the appropriate credentials when the drive has been removed from its cabinet and installed in another system.

4.5 Data Bands

When shipped from the factory, the drive is configured with a single data band called Band 0 (also known as the Global Data Band) which comprises LBA 0 through LBA max. The host may allocate additional bands (Band1 to Band15) by specifying a start LBA and an LBA range. The real estate for this band is taken from the Global Band.

Data bands cannot overlap but they can be sequential with one band ending at LBA (x) and the next beginning at LBA (x+1).

Each data band has its own drive-generated encryption key. The host may change the Encryption Key (see **Section 4.6 Cryptographic Erase**) or the password when required.

4.6 Cryptographic Erase

A valuable feature of SEDs is the ability to perform a cryptographic erase. This involves the host telling the drive to change the data encryption key for a particular band. Once changed, the data is no longer recoverable since it was written with one key and will be read using a different key. Since the drive overwrites the old key with the new one, and keeps no history of key the older key, the user data can never be recovered. This is done in a matter of seconds and is very useful if the drive is to be scrapped or repurposed.

4.7 Authenticated Firmware Download

In addition to providing a locking mechanism to prevent unwanted firmware download attempts, the drive also only accepts download files which have been cryptographically signed by the appropriate Seagate Design Center.

Three conditions must be met before the drive will allow the download operation;

1. The download must be an SED file. A standard drive (non-SED) file will be rejected.
2. The download file must be signed and authenticated.
3. As with a non-SED drive, the download file must pass the acceptance criteria for the drive. For example it must be applicable to the correct drive model, and have compatible revision and customer status.

4.8 Power Requirements

The standard drive models and the SED drive models have identical hardware, however the security and encryption portion of the drive controller ASIC is enabled and functional in the SED models. This represents a small additional drain on the 5V supply of about

30mA and a commensurate increase of about 150mW in power consumption. There is no additional drain on the 12V supply. See the tables in **Section 2.8 Power specifications** for power requirements on the standard (non-SED) drive models.

4.9 Supported Commands

The SED models support the following two commands in addition to the commands supported by the standard (non-SED) models as listed in **Table 10**:

- Trusted Send
- Trusted Receive

4.10 RevertSP

SED models will support the RevertSP feature which erases all data in all bands on the device and returns the contents of all SPs (Security Providers) on the device to their original factory state. In order to execute the RevertSP method the unique PSID (Physical Secure ID) printed on the drive label must be provided. PSID is not electronically accessible and can only be manually read from the drive label or scanned in via the 2D barcode.

5.0 SATA Interface

These drives use the industry-standard Serial ATA (SATA) interface that supports FIS data transfers. It supports ATA programmed input/output (PIO) modes 0 to 4; multiword DMA modes 0 to 2, and Ultra DMA modes 0 to 6.

For detailed information about the SATA interface, refer to the "Serial ATA: High Speed Serialized AT Attachment" specification.

5.1 Hot-Plug compatibility

Desktop HDD drives incorporate connectors which enable users to hot plug these drives in accordance with the SATA Revision 3.2 specification. This specification can be downloaded from www.serialata.org.

5.2 SATA device plug connector pin definitions

Table 9 summarizes the signals on the SATA interface and power connectors.

Table 9 SATA connector pin definitions

Segment	Pin	Function	Definition
Signal	S1	Ground	2nd mate
	S2	A+	Differential signal pair A from Phy
	S3	A-	
	S4	Ground	2nd mate
	S5	B-	Differential signal pair B from Phy
	S6	B+	
	S7	Ground	2nd mate
Key and spacing separate signal and power segments			
Power	P1	V ₃₃	3.3V power
	P2	V ₃₃	3.3V power
	P3	V ₃₃	3.3V power, pre-charge, 2nd mate
	P4	Ground	1st mate
	P5	Ground	2nd mate
	P6	Ground	2nd mate
	P7	V ₅	5V power, pre-charge, 2nd mate
	P8	V ₅	5V power
	P9	V ₅	5V power
	P10	Ground	2nd mate
	P11	Ground or LED signal	If grounded, drive does not use deferred spin
	P12	Ground	1st mate
	P13	V ₁₂	12V power, pre-charge, 2nd mate
	P14	V ₁₂	12V power
	P15	V ₁₂	12V power

Notes

- All pins are in a single row, with a 1.27 mm (0.050 in) pitch.
- The comments on the mating sequence apply to the case of backplane blindmate connector only. In this case, the mating sequences are:
 - the ground pins P4 and P12.
 - the pre-charge power pins and the other ground pins.
 - the signal pins and the rest of the power pins.
- There are three power pins for each voltage. One pin from each voltage is used for pre-charge when installed in a blind-mate backplane configuration.
 - All used voltage pins (V_x) must be terminated.

5.3 Supported ATA commands

The following table lists SATA standard commands that the drive supports.

For a detailed description of the ATA commands, refer to the Serial ATA International Organization: Serial ATA Revision 3.0 (<http://www.sata-io.org>).

See "S.M.A.R.T. commands" on page 36 for details and subcommands used in the S.M.A.R.T. implementation.

Table 10 SATA standard commands

Command name	Command code (in hex)
Check Power Mode	E5 _H
Device Configuration Freeze Lock	B1 _H / C1 _H
Device Configuration Identify	B1 _H / C2 _H
Device Configuration Restore	B1 _H / C0 _H
Device Configuration Set	B1 _H / C3 _H
Device Reset	08 _H
Download Microcode	92 _H
Execute Device Diagnostics	90 _H
Flush Cache	E7 _H
Flush Cache Extended	EA _H
Format Track	50 _H
Identify Device	EC _H
Idle	E3 _H
Idle Immediate	E1 _H
Initialize Device Parameters	91 _H
Read Buffer	E4 _H
Read DMA	C8 _H
Read DMA Extended	25 _H
Read DMA Without Retries	C9 _H
Read Log Ext	2F _H
Read Multiple	C4 _H
Read Multiple Extended	29 _H
Read Native Max Address	F8 _H
Read Native Max Address Extended	27 _H
Read Sectors	20 _H
Read Sectors Extended	24 _H
Read Sectors Without Retries	21 _H
Read Verify Sectors	40 _H
Read Verify Sectors Extended	42 _H
Read Verify Sectors Without Retries	41 _H
Recalibrate	10 _H
Security Disable Password	F6 _H
Security Erase Prepare	F3 _H
Security Erase Unit	F4 _H

Table 10 SATA standard commands (continued)

Command name	Command code (in hex)	
Security Freeze	F5 _H	
Security Set Password	F1 _H	
Security Unlock	F2 _H	
Seek	70 _H	
Set Features	EF _H	
Set Max Address	F9 _H	
Note: Individual Set Max Address commands are identified by the value placed in the Set Max Features register as defined to the right.	Address: Password: Lock: Unlock: Freeze Lock:	00 _H 01 _H 02 _H 03 _H 04 _H
Set Max Address Extended	37 _H	
Set Multiple Mode	C6 _H	
Sleep	E6 _H	
S.M.A.R.T. Disable Operations	B0 _H / D9 _H	
S.M.A.R.T. Enable/Disable Autosave	B0 _H / D2 _H	
S.M.A.R.T. Enable Operations	B0 _H / D8 _H	
S.M.A.R.T. Execute Offline	B0 _H / D4 _H	
S.M.A.R.T. Read Attribute Thresholds	B0 _H / D1 _H	
S.M.A.R.T. Read Data	B0 _H / D0 _H	
S.M.A.R.T. Read Log Sector	B0 _H / D5 _H	
S.M.A.R.T. Return Status	B0 _H / DA _H	
S.M.A.R.T. Save Attribute Values	B0 _H / D3 _H	
S.M.A.R.T. Write Log Sector	B0 _H / D6 _H	
Standby	E2 _H	
Standby Immediate	E0 _H	
Write Buffer	E8 _H	
Write DMA	CA _H	
Write DMA Extended	35 _H	
Write DMA FUA Extended	3D _H	
Write DMA Without Retries	CB _H	
Write Log Extended	3F _H	
Write Multiple	C5 _H	
Write Multiple Extended	39 _H	
Write Multiple FUA Extended	CE _H	
Write Sectors	30 _H	
Write Sectors Without Retries	31 _H	
Write Sectors Extended	34 _H	
Write Uncorrectable	45 _H	

5.3.1 Identify Device command

The Identify Device command (command code EC_H) transfers information about the drive to the host following power up. The data is organized as a single 512-byte block of data, whose contents are shown in on page 29. All reserved bits or words should be set to zero. Parameters listed with an "x" are drive-specific or vary with the state of the drive.

The following commands contain drive-specific features that may not be included in the SATA specification.

Table 11 Identify Device commands

Word	Description	Value
0	Configuration information: Bit 15: 0 = ATA; 1 = ATAPI Bit 7: removable media Bit 6: removable controller Bit 0: reserved	0C5A _H
1	Number of logical cylinders	16,383
2	ATA-reserved	0000 _H
3	Number of logical heads	16
4	Retired	0000 _H
5	Retired	0000 _H
6	Number of logical sectors per logical track: 63	003F _H
7–9	Retired	0000 _H
10–19	Serial number: (20 ASCII characters, 0000 _H = none)	ASCII
20	Retired	0000 _H
21	Retired	0400 _H
22	Obsolete	0000 _H
23–26	Firmware revision (8 ASCII character string, padded with blanks to end of string)	x.xx
27–46	Drive model number: (40 ASCII characters, padded with blanks to end of string)	
47	(Bits 7–0) Maximum sectors per interrupt on Read multiple and Write multiple (16)	8010 _H
48	Reserved	0000 _H
49	Standard Standby timer, IORDY supported and may be disabled	2F00 _H
50	ATA-reserved	0000 _H
51	PIO data-transfer cycle timing mode	0200 _H
52	Retired	0200 _H
53	Words 54–58, 64–70 and 88 are valid	0007 _H
54	Number of current logical cylinders	xxxx _H
55	Number of current logical heads	xxxx _H
56	Number of current logical sectors per logical track	xxxx _H
57–58	Current capacity in sectors	xxxx _H

Table 11 Identify Device commands (continued)

Word	Description	Value
59	Number of sectors transferred during a Read Multiple or Write Multiple command	xxxx _H
60–61	Total number of user-addressable LBA sectors available (see Section 2.2 for related information) *Note: The maximum value allowed in this field is: 0FFFFFFF _H (268,435,455 sectors, 137GB). Drives with capacities over 137GB will have 0FFFFFFF _H in this field and the actual number of user-addressable LBAs specified in words 100–103. This is required for drives that support the 48-bit addressing feature.	0FFFFFFF _H *
62	Retired	0000 _H
63	Multiword DMA active and modes supported (see note following this table)	xx07 _H
64	Advanced PIO modes supported (modes 3 and 4 supported)	0003 _H
65	Minimum multiword DMA transfer cycle time per word (120 nsec)	0078 _H
66	Recommended multiword DMA transfer cycle time per word (120 nsec)	0078 _H
67	Minimum PIO cycle time without IORDY flow control (240 nsec)	0078 _H
68	Minimum PIO cycle time with IORDY flow control (120 nsec)	0078 _H
69–74	ATA-reserved	0000 _H
75	Queue depth	001F _H
76	SATA capabilities	xxxx _H
77	Reserved for future SATA definition	xxxx _H
78	SATA features supported	xxxx _H
79	SATA features enabled	xxxx _H
80	Major version number	01F0 _H
81	Minor version number	0028 _H
82	Command sets supported	364B _H
83	Command sets supported	7F09 _H
84	Command sets support extension (see note following this table)	4163 _H
85	Command sets enabled	30xx _H
86	Command sets enabled	BE09 _H
87	Command sets enable extension	4163 _H
88	Ultra DMA support and current mode (see note following this table)	xx7F _H
89	Security erase time	0039 _H
90	Enhanced security erase time	0039 _H
92	Master password revision code	FFFE _H
93	Hardware reset value	xxxx _H
94	Automatic acoustic management	8080 _H
95–99	ATA-reserved	0000 _H

Table 11 Identify Device commands (continued)

Word	Description	Value
100–103	Total number of user-addressable LBA sectors available (see Section 2.2 for related information). These words are required for drives that support the 48-bit addressing feature. Maximum value: 0000FFFFFFFFFh.	ST3000DM001 = 5,860,533,168 ST3000DM002 = 5,860,533,168 ST2000DM001 = 3,907,029,168 ST2000DM002 = 3,907,029,168 ST1500DM003 = 2,930,277,168 ST1000DM003 = 1,953,525,168 ST1000DM004 = 1,953,525,168 ST750DM003 = 1,465,149,168 ST500DM002 = 976,773,168 ST320DM000 = 625,142,448 ST250DM000 = 488,397,168
104–107	ATA-reserved	0000 _H
108–111	The mandatory value of the world wide name (WWN) for the drive. NOTE: This field is valid if word 84, bit 8 is set to 1 indicating 64-bit WWN support.	Each drive will have a unique value.
112–127	ATA-reserved	0000 _H
128	Security status	0001 _H
129–159	Seagate-reserved	xxxx _H
160–254	ATA-reserved	0000 _H
255	Integrity word	xxA5 _H

Advanced Power Management (APM) and Automatic Acoustic Management (AAM) features are not supported.

See the bit descriptions below for words 63, 84, and 88 of the Identify Drive data.

Description (if bit is set to 1)		
	Bit	Word 63
	0	Multiword DMA mode 0 is supported.
	1	Multiword DMA mode 1 is supported.
	2	Multiword DMA mode 2 is supported.
	8	Multiword DMA mode 0 is currently active.
	9	Multiword DMA mode 1 is currently active.
	10	Multiword DMA mode 2 is currently active.
	Bit	Word 84
	0	SMART error login is supported.
	1	SMART self-test is supported.
	2	Media serial number is supported.
	3	Media Card Pass Through Command feature set is supported.
	4	Streaming feature set is supported.
	5	GPL feature set is supported.

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	6	WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands are supported.
	7	WRITE DMA QUEUED FUA EXT command is supported
	8	64-bit World Wide Name is supported.
	9-10	Obsolete.
	11-12	Reserved for TLC.
	13	IDLE IMMEDIATE command with IUNLOAD feature is supported.
	14	Shall be set to 1.
	15	Shall be cleared to 0.
	Bit	Word 88
	0	Ultra DMA mode 0 is supported.
	1	Ultra DMA mode 1 is supported.
	2	Ultra DMA mode 2 is supported.
	3	Ultra DMA mode 3 is supported.
	4	Ultra DMA mode 4 is supported.
	5	Ultra DMA mode 5 is supported.
	6	Ultra DMA mode 6 is supported.
	8	Ultra DMA mode 0 is currently active.
	9	Ultra DMA mode 1 is currently active.
	10	Ultra DMA mode 2 is currently active.
	11	Ultra DMA mode 3 is currently active.
	12	Ultra DMA mode 4 is currently active.
	13	Ultra DMA mode 5 is currently active.
	14	Ultra DMA mode 6 is currently active.

5.3.2 Set Features command

This command controls the implementation of various features that the drive supports. When the drive receives this command, it sets BSY, checks the contents of the Features register, clears BSY and generates an interrupt. If the value in the register does not represent a feature that the drive supports, the command is aborted. Power-on default has the read look-ahead and write caching features enabled. The acceptable values for the Features register are defined as follows:

Table 12 Set Features command

02 _H	Enable write cache (<i>default</i>).
03 _H	Set transfer mode (based on value in Sector Count register). Sector Count register values:
00 _H	Set PIO mode to default (PIO mode 2).
01 _H	Set PIO mode to default and disable IORDY (PIO mode 2).
08 _H	PIO mode 0
09 _H	PIO mode 1
0A _H	PIO mode 2
0B _H	PIO mode 3
0C _H	PIO mode 4 (<i>default</i>)
20 _H	Multiword DMA mode 0
21 _H	Multiword DMA mode 1
22 _H	Multiword DMA mode 2
40 _H	Ultra DMA mode 0
41 _H	Ultra DMA mode 1
42 _H	Ultra DMA mode 2
43 _H	Ultra DMA mode 3
44 _H	Ultra DMA mode 4
45 _H	Ultra DMA mode 5
46 _H	Ultra DMA mode 6
10 _H	Enable use of SATA features
55 _H	Disable read look-ahead (read cache) feature.
82 _H	Disable write cache
90 _H	Disable use of SATA features
AA _H	Enable read look-ahead (read cache) feature (<i>default</i>).
F1 _H	Report full capacity available

At power-on, or after a hardware or software reset, the default values of the features are as indicated above.

5.3.3 S.M.A.R.T. commands

S.M.A.R.T. provides near-term failure prediction for disk drives. When S.M.A.R.T. is enabled, the drive monitors predetermined drive attributes that are susceptible to degradation over time. If self-monitoring determines that a failure is likely, S.M.A.R.T. makes a status report available to the host. Not all failures are predictable. S.M.A.R.T. predictability is limited to the attributes the drive can monitor. For more information on S.M.A.R.T. commands and implementation, see the *Draft ATA-5 Standard*.

SeaTools diagnostic software activates a built-in drive self-test (DST S.M.A.R.T. command for D4_H) that eliminates unnecessary drive returns. The diagnostic software ships with all new drives and is also available at: <http://seatools.seagate.com>.

This drive is shipped with S.M.A.R.T. features disabled. Users must have a recent BIOS or software package that supports S.M.A.R.T. to enable this feature. The table below shows the S.M.A.R.T. command codes that the drive uses.

Table 13 S.M.A.R.T. commands

Code in features register	S.M.A.R.T. command
D0 _H	S.M.A.R.T. Read Data
D2 _H	S.M.A.R.T. Enable/Disable Attribute Autosave
D3 _H	S.M.A.R.T. Save Attribute Values
D4 _H	S.M.A.R.T. Execute Off-line Immediate (runs DST)
D5 _H	S.M.A.R.T. Read Log Sector
D6 _H	S.M.A.R.T. Write Log Sector
D8 _H	S.M.A.R.T. Enable Operations
D9 _H	S.M.A.R.T. Disable Operations
DA _H	S.M.A.R.T. Return Status

If an appropriate code is not written to the Features Register, the command is aborted and 0x04 (abort) is written to the Error register.



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January 2015

EXHIBIT 19



Desktop HDD

Product Manual

Standard models

ST3000DM001
ST2000DM001
ST1500DM003
ST1000DM003
ST750DM003
ST500DM002
ST320DM000
ST250DM000

Self-Encryption models

ST3000DM002
ST2000DM002
ST1000DM004

100686584, Rev. P
Gen 14 - September 2015

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Revision	Date	Description of Change
Rev. A.	08/19/2011	Initial release.
Rev. B	09/01/2011	Updated decibel specifications, start/stop times, Table 3; mounting drawing.
Rev. C	10/20/2011	Updated voltage tolerance specifications.
Rev. D	01/17/2012	Corrected Table 1 (Altitude, operating) specification and Table 5 (Idle2).
Rev. E	06/11/2012	Updated Index.
Rev. F	09/05/2012	Added 2.5A spin-up code option (Table 1 and Table 2); page 17.
Rev. G	10/01/2012	Updated Table 1 and Table 2 with rated workload information. Updated DC power requirements (Tables 1, 3 and 4).
Rev. H	03/21/2014	Revised Rated Workload statement (pages 5 & 7); LP height updated & new mechanical drawings (pages 4, 9 & 20-21); Revised max storage note (page 13)
Rev. J	05/08/2014	Updated product name (pages fc, 2, 19 & 22) and Add metric "mm" values to mechanical drawings. (pages 20-21).
Rev. K	08/28/2014	Add SED models and SED Section 4.0 (pages: fc, 2, 4, 7, 22-23 & 29)
Rev. L	01/26/2015	Applied new logo (pages: fc & bc), applied latest page numbering convention (pages: all), added AFR = <1.0% & update Rated Workload text (pages: 9 & 11), added Case Temp note & changed "&" to "%" in Storage note (page: 17), add Reliability Section 2.12 (page: 20), cleaned up text in Mechanical Drawings (pages: 24-25) & revised SED section 4.0 (pages: 26-27).
Rev. M	03/10/2015	Change Max Case Temperature to 69°C (page: 17)
Rev. N	08/18/2015	New cover design (page: fc) Replaced mechanical drawings to correct side hole dimension (pages: 24-25)
Rev. P	09/01/2015	Revised Rated Workload statement (pages: 9, 11 & 20)

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When referring to drive capacity, one gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes. Your computer's operating system may use a different standard of measurement and report a lower capacity. In addition, some of the listed capacity is used for formatting and other functions, and thus will not be available for data storage. Actual quantities will vary based on various factors, including file size, file format, features and application software. Actual data rates may vary depending on operating environment and other factors. The export or re-export of hardware or software containing encryption may be regulated by the U.S. Department of Commerce, Bureau of Industry and Security (for more information, visit www.bis.doc.gov), and controlled for import and use outside of the U.S. Seagate reserves the right to change, without notice, product offerings or specifications.

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- Authorized Service Centers

For information regarding Warranty Support, visit: <http://www.seagate.com/support/warranty-and-replacements/>

For information regarding data recovery services, visit: <http://www.seagate.com/services-software/seagate-recovery-services/recover/>

For Seagate OEM and Distribution partner portal, visit: <http://www.seagate.com/partners>

For Seagate reseller portal, visit: <http://www.seagate.com/partners>

1.0 Introduction

This manual describes the functional, mechanical and interface specifications for the following:
Seagate® Desktop HDD model drives:

Standard models		Self-Encryption models
ST3000DM001	ST750DM003	ST3000DM002
ST2000DM001	ST500DM002	ST2000DM002
ST1500DM003	ST320DM000	ST1000DM004
ST1000DM003	ST250DM000	

Note	Previous generations of Seagate Self-Encrypting Drive models were called Full Disk Encryption (FDE) models before a differentiation between drive-based encryption and other forms of encryption was necessary.
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These drives provide the following key features:

- 7200 RPM spindle speed.
- High instantaneous (burst) data-transfer rates (up to 600MB per second).
- TGM recording technology provides the drives with increased areal density.
- State-of-the-art cache and on-the-fly error-correction algorithms.
- Native Command Queuing with command ordering to increase performance in demanding applications.
- Full-track multiple-sector transfer capability without local processor intervention.
- Seagate AcuTrac™ servo technology delivers dependable performance, even with hard drive track widths of only 75 nanometers.
- Seagate OptiCache™ technology boosts overall performance by as much as 45% over the previous generation.
- Seagate SmartAlign™ technology provides a simple, transparent migration to Advanced Format 4K sectors
- Quiet operation.
- Compliant with RoHS requirements in China and Europe.
- SeaTools diagnostic software performs a drive self-test that eliminates unnecessary drive returns.
- Support for S.M.A.R.T. drive monitoring and reporting.
- Supports latching SATA cables and connectors.
- Worldwide Name (WWN) capability uniquely identifies the drive.

1.1 About the SATA interface

The Serial ATA (SATA) interface provides several advantages over the traditional (parallel) ATA interface. The primary advantages include:

- Easy installation and configuration with true plug-and-play connectivity. It is not necessary to set any jumpers or other configuration options.
- Thinner and more flexible cabling for improved enclosure airflow and ease of installation.
- Scalability to higher performance levels.

In addition, SATA makes the transition from parallel ATA easy by providing legacy software support. SATA was designed to allow users to install a SATA host adapter and SATA disk drive in the current system and expect all of the existing applications to work as normal.

The SATA interface connects each disk drive in a point-to-point configuration with the SATA host adapter. There is no master/slave relationship with SATA devices like there is with parallel ATA. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both "masters" on two separate ports. This essentially means both drives behave as if they are Device 0 (master) devices.

The SATA host adapter and drive share the function of emulating parallel ATA device behavior to provide backward compatibility with existing host systems and software. The Command and Control Block registers, PIO and DMA data transfers, resets, and interrupts are all emulated.

The SATA host adapter contains a set of registers that shadow the contents of the traditional device registers, referred to as the Shadow Register Block. All SATA devices behave like Device 0 devices. For additional information about how SATA emulates parallel ATA, refer to the "Serial ATA International Organization: Serial ATA Revision 3.0". The specification can be downloaded from www.sata-io.org.

Note

The host adapter may, optionally, emulate a master/slave environment to host software where two devices on separate SATA ports are represented to host software as a Device 0 (master) and Device 1 (slave) accessed at the same set of host bus addresses. A host adapter that emulates a master/slave environment manages two sets of shadow registers. This is not a typical SATA environment.

2.0 Drive Specifications

Unless otherwise noted, all specifications are measured under ambient conditions, at 25°C, and nominal power. For convenience, the phrases *the drive* and *this drive* are used throughout this manual to indicate the following drive models:

Standard models		Self-Encryption models
ST3000DM001	ST750DM003	ST3000DM002
ST2000DM001	ST500DM002	ST2000DM002
ST1500DM003	ST320DM000	ST1000DM004
ST1000DM003	ST250DM000	

2.1 Specification summary tables

The specifications listed in [Table 1](#) and [Table 2](#) are for quick reference. For details on specification measurement or definition, refer to the appropriate section of this manual.

Table 1 Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models

Drive Specification*	ST3000DM001 & ST3000DM002; ST2000DM001	ST2000DM001 & ST2000DM002; ST1500DM003	ST1000DM003 & ST1000DM004; ST750DM003
Formatted capacity (512 bytes/sector)**	3000GB (3TB); 2000GB (2TB)	2000GB (2TB); 1500GB (1.5TB)	1000GB (1TB); 750GB
Guaranteed sectors	5,860,533,168; 3,907,029,168	3,907,029,168; 2,930,277,168	1,953,525,168; 1,465,149,168
Heads	6	4	2
Disks	3	2	1
Bytes per sector (4K physical emulated at 512-byte sectors)	4096		
Default sectors per track	63		
Default read/write heads	16		
Default cylinders	16,383		
Recording density (max)	1807kFCI		
Track density (avg)	352ktracks/in		
Areal density (avg)	625Gb/in ²		
Spindle speed	7200 RPM		
Internal data transfer rate (max)	2147Mb/s		
Average data rate, read/write (MB/s)	156MB/s		
Maximum sustained data rate, OD read (MB/s)	210MB/s		
I/O data-transfer rate (max)	600MB/s		
Cache buffer	64MB		
Height (max)	26.1mm / 1.028 in		19.98mm / 0.787 in
Width (max)	101.6mm / 4.0 in (± 0.010 in)		101.6mm / 4.0 in (± 0.010 in)
Length (max)	146.99mm / 5.787 in		146.99mm / 5.787 in
Weight (typical)	626g / 1.38 lb	535g / 1.18 lb	400g / 0.88 lb
Average latency	4.16ms		
Power-on to ready (max)	<17.0s		<10.0s
Power-on to ready, 2.5A spin-up code option (typical)	<10.0s		n/a
Standby to ready (max)	<17.0s		<10.0s
Average seek, read (typical) Average seek, write (typical)	<8.5ms typical <9.5ms typical		
Startup current 12V	2.0A or 2.8A		2.0A
Voltage tolerance (including noise)	5V: ±5% 12V: +10% / -7.5%		

Table 1 Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models (continued)

Drive Specification*	ST3000DM001 & ST3000DM002; ST2000DM001	ST2000DM001 & ST2000DM002; ST1500DM003	ST1000DM003 & ST1000DM004; ST750DM003
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)		
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)		
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)		
Relative humidity gradient (max)	30% per hour		
Wet bulb temperature (max)	37.7°C max (operating) 40.0°C max (non-operating)		
Altitude, operating	-304.8m to 3048m (-1000 ft to 10,000+ ft)		
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)		
Operational shock (max)	80 Gs at 2ms		
Non-operational shock (max)	300 Gs at 2ms		350 Gs at 2ms
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power			
Idle***	2.4 bels (typical) 2.6 bels (max)		2.2 bels (typical) 2.4 bels (max)
Seek	2.6 bels (typical) 2.7 bels (max)		2.4 bels (typical) 2.5 bels (max)
Non-recoverable read errors	1 per 10 ¹⁴ bits read		
Annualized Failure Rate (AFR)	<1.0% based on 2400 POH		
Rated Workload	Average annualized workload rating: <55 TB/year. The AFR specification for the product assumes the I/O workload does not exceed the average annualized workload rate limit of 55 TB/year. Workloads exceeding the annualized rate may degrade the product AFR and impact reliability as experienced by the particular application. The average annualized workload rate limit is in units of TB per calendar year.		
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: http://www.seagate.com/support/warranty-and-replacements/ . From this page, click on "Check to see if the drive is under Warranty". Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.		
Load/Unload cycles (25°C, 50% rel. humidity)	300,000		
Supports Hotplug operation per the Serial ATA Revision 3.2 specification	Yes		

*All specifications above are based on native configurations.

** One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

*** During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

Table 2 Drive specifications summary for 500GB, 320GB and 250GB models

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Formatted capacity**	500GB	320GB	250GB
Guaranteed sectors	976,773,168	625,142,448	488,397,168
Heads	2		1
Disks	1		
Bytes per sector (4K physical emulated at 512-byte sectors)	4096		
Default sectors per track	63		
Default read/write heads	16		
Default cylinders	16,383		
Recording density (max)	1413kb/in		
Track density (avg)	236ktracks/in		
Areal density (avg)	329Gb/in ²		
Spindle speed	7200 RPM		
Internal data transfer rate (max)	1695Mb/s		
Average Data Rate, read/write (MB/s)	125MB/s		
Maximum sustained data transfer rate, OD read	144MB/s		
I/O data-transfer rate (max.)	600MB/s		
Cache buffer	16MB		
Height (max)	19.98mm / 0.787 in		
Width (max)	101.6mm / 4.0 in (± 0.010 in)		
Length (max)	146.99mm / 5.787 in		
Weight (typical)	415g / 0.915 lb		
Average latency	4.16ms		
Power-on to ready (max)	<8.5s		
Standby to ready (max)	<8.5s		
Average seek, read (typical)	<8.5ms (read)		
Average seek, write (typical)	<9.5ms (write)		
Startup current (typical) 12V	2.0A		
Voltage tolerance (including noise)	5V: ±5% 12V: +10% / -7.5%		
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)		
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)		
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)		
Relative humidity gradient (max)	30% per hour		
Wet bulb temperature (max)	37.7°C (operating) 40.0°C (non-operating)		
Altitude, operating	-304.8m to 3048m (-1000 ft to 10,000+ ft)		
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)		
Operational shock (max)	70 Gs at 2ms		
Non-operational shock (max)	350 Gs at 2ms		
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power			

Table 2 Drive specifications summary for 500GB, 320GB and 250GB models (continued)

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Idle***		2.2 bels (typical) 2.3 bels (max)	
Seek		2.3 bels (typical) 2.4 bels (max)	
Non-recoverable read errors	1 per 10 ¹⁴ bits read		
Annualized Failure Rate (AFR)	<1.0% based on 2400 POH		
Rated Workload	Average annualized workload rating: <55 TB/year. The AFR specification for the product assumes the I/O workload does not exceed the average annualized workload rate limit of 55 TB/year. Workloads exceeding the annualized rate may degrade the product AFR and impact reliability as experienced by the particular application. The average annualized workload rate limit is in units of TB per calendar year.		
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: http://www.seagate.com/support/warranty-and-replacements/ . From this page, click on "Check to see if the drive is under Warranty". Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.		
Contact start-stop cycles	50,000 at 25°C, 50% rel. humidity		
Supports Hotplug operation per the Serial ATA Revision 3.2 specification	Yes		

* All specifications above are based on native configurations.

** One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

*** During periods of drive idle, some offline activity may occur according to the SMART specification, which may increase acoustic and power to operational levels.

2.2 Formatted capacity

Model	Formatted capacity*	Guaranteed sectors	Bytes per sector
ST3000DM001 ST3000DM002	3000GB	5,860,533,168	4K
ST2000DM001 ST2000DM002	2000GB	3,907,029,168	
ST1500DM003	1500GB	2,930,277,168	
ST1000DM003 ST1000DM004	1000GB	1,953,525,168	
ST750DM003	750GB	1,465,149,168	
ST500DM002	500GB	976,773,168	
ST320DM000	320GB	625,142,448	
ST250DM000	250GB	488,397,168	

*One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

2.2.1 LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to $n-1$, where n is the number of guaranteed sectors as defined above.

See Section 5.3.1, "Identify Device command" (words 60-61 and 100-103) for additional information about 48-bit addressing support of drives with capacities over 137GB.

2.3 Default logical geometry

- **Cylinders:** 16,383
- **Read/write heads:** 16
- **Sectors per track:** 63

LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to $n-1$, where n is the number of guaranteed sectors as defined above.

2.4 Recording and interface technology

Interface	SATA
Recording method	TGMR
Recording density (kFCI)	
3TB, 2TB, 1.5TB, 1TB and 750GB models	1807
500GB, 320GB and 250GB models	1413
Track density (ktracks/inch avg)	352
Areal density (Gb/in²)	
3TB, 2TB, 1.5TB, 1TB and 750GB models	625
500GB, 320GB, 250GB models	329
Spindle speed (RPM)	7200 \pm 0.2%
Internal data transfer rate (Mb/s max)	2147
Maximum sustained data transfer rate, OD read (MB/s)	
3TB, 2TB, 1.5TB, 1TB and 750GB models	210
500GB, 320GB, 250GB models	144
Average data rate, read/write (MB/s)	
3TB, 2TB, 1.5TB, 1TB and 750GB models	156
500GB, 320GB, 250GB models	125
I/O data-transfer rate (MB/s max)	600

2.5 Physical characteristics

Maximum height	
3TB, 2TB and 1.5TB	26.1mm / 1.028 in
1TB, 750GB, 500GB, 320GB, 250GB	19.98mm / 0.787 in
Maximum width (all models)	101.6mm / 4.0 in (± 0.010 in)
Maximum length (all models)	146.99mm / 5.787 in
Typical weight	
3TB and 2TB	626g / 1.38 lb
1.5TB	535g / 1.18 lb
1TB and 750GB	400g / 0.88 lb
500GB, 320GB, 250GB	415g / 0.92 lb
Cache buffer	
3TB, 2TB, 1.5TB, 1TB, 750GB	64MB (64,768kb)
500GB, 320GB and 250GB	16MB (16,384kb)

2.6 Seek time

Seek measurements are taken with nominal power at 25°C ambient temperature. All times are measured using drive diagnostics. The specifications in the table below are defined as follows:

- Track-to-track seek time is an average of all possible single-track seeks in both directions.
- Average seek time is a true statistical random average of at least 5000 measurements of seeks between random tracks, less overhead.

Typical seek times (ms)	Read	Write
Track-to-track	1.0	1.2
Average	8.5	9.5
Average latency	4.16	

Note

These drives are designed to consistently meet the seek times represented in this manual. Physical seeks, regardless of mode (such as track-to-track and average), are expected to meet the noted values. However, due to the manner in which these drives are formatted, benchmark tests that include command overhead or measure logical seeks may produce results that vary from these specifications.

2.7 Start/stop times

	3-disk (3TB, 2TB models)	2-disk (2TB, 1.5TB models)	1-disk (1TB, 750GB models)	1-disk (250GB, 320GB, 500GB models)
Power-on to ready (in seconds)	15 (typical) 17 (max)		10 (typical) 12 (max)	8.5 (typical) 10 (max)
Power-on to ready, 2.5A spin-up code option (in seconds, typical)	<10		n/a	
Standby to ready (in seconds)	15 (typical) 17 (max)		10 (typical) 12 (max)	8.5 (typical) 10 (max)
Ready to spindle stop (in seconds)	10 (typical) 11 (max)		10 (typical) 11 (max)	

Time-to-ready may be longer than normal if the drive power is removed without going through normal OS powerdown procedures.

2.8 Powerspecifications

The drive receives DC power (+5V or +12V) through a native SATA power connector. Refer to

23.

2.8.1 Power consumption

Power requirements for the drives are listed in 3, 4, 5 and 6. Typical power measurements are based on an average of drives tested, under nominal conditions, using 5.0V and 12.0V input voltage at 25°C ambient temperature.

- **Spinup power**
Spinup power is measured from the time of power-on to the time that the drive spindle reaches operating speed.
- **Read/write power and current**
Read/write power is measured with the heads on track, based on a 16-sector write followed by a 32-ms delay, then a 16-sector read followed by a 32-ms delay.
- **Operating power and current**
Operating power is measured using 40 percent random seeks, 40 percent read/write mode (1 write for each 10 reads) and 20 percent drive idle mode.
- **Idle mode power**
Idle mode power is measured with the drive up to speed, with servo electronics active and with the heads in a random track location.
- **Standby mode**
During Standby mode, the drive accepts commands, but the drive is not spinning, and the servo and read/write electronics are in power-down mode.

Table 3 DC power requirements (3-disk: 3TB and 2TB models)

Power dissipation (3-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0A or 2.8A
Idle2* †	5.40	0.190	0.377
Operating	8.00	0.510	0.462
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

Table 4 DC power requirements (2-disk: 2TB and 1.5TB models)

Power dissipation (2-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0A or 2.8A
Idle2* †	4.50	0.196	0.296
Operating	6.70	0.525	0.340
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

Table 5 DC power requirements (1-disk: 1TB and 750GB models)

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0
Idle2* †	3.36	0.152	0.216
Operating	5.90	0.500	0.329
Standby	0.63	0.111	0.006
Sleep	0.63	0.111	0.006

Table 6 DC power requirements (1-disk: 500, 320 and 250GB models)

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0
Perf Idle* †	4.60	0.378	0.224
Operating	6.19	0.656	0.243
Standby	0.79	0.350	0.010
Sleep	0.79	0.350	0.010

*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

†5W IDLE with DIPLM Enabled

2.8.2 Conducted noise

Input noise ripple is measured at the host system power supply across an equivalent 80-ohm resistive load on the +12 volt line or an equivalent 15-ohm resistive load on the +5 volt line.

- Using 12-volt power, the drive is expected to operate with a maximum of 120 mV peak-to-peak square-wave injected noise at up to 10MHz.
- Using 5-volt power, the drive is expected to operate with a maximum of 100 mV peak-to-peak square-wave injected noise at up to 10MHz.

Note	Equivalent resistance is calculated by dividing the nominal voltage by the typical RMS read/write current.
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2.8.3 Voltage tolerance

Voltage tolerance (including noise):

- 5V $\pm 5\%$
- 12V $+10\%$ / -7.5%

2.8.4 Power-management modes

The drive provides programmable power management to provide greater energy efficiency. In most systems, users can control power management through the system setup program. The drive features the following power-management modes:

Power modes	Heads	Spindle	Buffer
Active	Tracking	Rotating	Enabled
Idle	Tracking	Rotating	Enabled
Standby	Parked	Stopped	Enabled
Sleep	Parked	Stopped	Disabled

- **Active mode**
The drive is in Active mode during the read/write and seek operations.
- **Idle mode**
The buffer remains enabled, and the drive accepts all commands and returns to Active mode any time disk access is necessary.
- **Standby mode**
The drive enters Standby mode when the host sends a Standby Immediate command. If the host has set the standby timer, the drive can also enter Standby mode automatically after the drive has been inactive for a specifiable length of time. The standby timer delay is established using a Standby or Idle command. In Standby mode, the drive buffer is enabled, the heads are parked and the spindle is at rest. The drive accepts all commands and returns to Active mode any time disk access is necessary.
- **Sleep mode**
The drive enters Sleep mode after receiving a Sleep command from the host. In Sleep mode, the drive buffer is disabled, the heads are parked and the spindle is at rest. The drive leaves Sleep mode after it receives a Hard Reset or Soft Reset from the host. After receiving a reset, the drive exits Sleep mode and enters Standby mode with all current translation parameters intact.
- **Idle and Standby timers**
Each time the drive performs an Active function (read, write or seek), the standby timer is reinitialized and begins counting down from its specified delay times to zero. If the standby timer reaches zero before any drive activity is required, the drive makes a transition to Standby mode. In both Idle and Standby mode, the drive accepts all commands and returns to Active mode when disk access is necessary.

2.9 Environmental specifications

This section provides the temperature, humidity, shock, and vibration specifications. Ambient temperature is defined as the temperature of the environment immediately surrounding the drive. Above 1000ft. (305 meters), the maximum temperature is derated linearly by 1°C every 1000 ft.

Note

The maximum allowable drive case temperature is 69°C.
See Figures 2 & 3 for HDA case temperature measurement locations.

Refer to [Figure 2](#) for mounting for base plate measurement location.

2.9.1 Ambient temperature

Operating	0° to 60°C (32° to 140°F)
Non-operating	–40° to 70°C (–40° to 158°F)

2.9.2 Temperature gradient

Operating	20°C per hour (68°F per hour max), without condensation
Non-operating	30°C per hour (86°F per hour max)

2.9.3 Humidity

2.9.3.1 Relative humidity

Operating	5% to 95% non-condensing (30% per hour max)
Nonoperating	5% to 95% non-condensing (30% per hour max)

2.9.3.2 Wet bulb temperature

Operating	37.7°C (99.9°F max)
Non-operating	40°C (104°F max)

2.9.4 Altitude

Operating	–304.8m to 3048m (–1000 ft. to 10,000+ ft.)
Non-operating	–304.8m to 12,192m (–1000 ft. to 40,000+ ft.)

Note

Maximum storage condition not to exceed 90 days at a wetbulb temperature of 32°C (example: 34°C / 90% RH)

2.9.5 Shock

All shock specifications assume that the drive is mounted securely with the input shock applied at the drive mounting screws. Shock may be applied in the X, Y or Z axis.

2.9.5.1 Operating shock

These drives comply with the performance levels specified in this document when subjected to a maximum operating shock of 80 Gs based on half-sine shock pulses of 2 ms during read operations. Shocks should not be repeated more than two times per second.

2.9.5.2 Non-operating shock

3TB, 2TB and 1.5TB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 300 Gs based on a non-repetitive half-sine shock pulse of 2 ms duration.

1TB, 750GB, 500GB, 320GB and 250GB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 350 Gs based on a non-repetitive half-sine shock pulse of 2-ms duration.

2.9.5.3 Operating vibration

The maximum vibration levels that the drive may experience while meeting the performance standards specified in this document are specified below.

2Hz to 22Hz	0.25 Gs (Limited displacement)
22Hz to 350Hz	0.50 Gs
350Hz to 500Hz	0.25 Gs

All vibration specifications assume that the drive is mounted securely with the input vibration applied at the drive mounting screws. Vibration may be applied in the X, Y or Z axis. Throughput may vary if improperly mounted.

2.9.6 Non-operating vibration

The maximum non-operating vibration levels that the drive may experience without incurring physical damage or degradation in performance when subsequently put into operation are specified below.

5Hz to 22Hz	3.0 Gs (Limited displacement)
22Hz to 350Hz	3.0 Gs
350Hz to 500Hz	3.0 Gs

2.10 Acoustics

Drive acoustics are measured as overall A-weighted acoustic sound power levels (no pure tones). All measurements are consistent with ISO document 7779. Sound power measurements are taken under essentially free-field conditions over a reflecting plane. For all tests, the drive is oriented with the cover facing upward.

Note	For seek mode tests, the drive is placed in seek mode only. The number of seeks per second is defined by the following equation:
	$(\text{Number of seeks per second} = 0.4 / (\text{average latency} + \text{average access time}))$

Table 7 Fluid Dynamic Bearing (FDB) motor acoustics

	Idle*	Seek
3 Disks (3TB, 2TB)	2.4 bels (typical) 2.6 bels (max)	2.6 bels (typical) 2.7 bels (max)
2 Disks (2TB, 1.5TB)		
1 Disk (1TB, 750GB)	2.2 bels (typical) 2.3 bels (max)	2.3 bels (typical) 2.4 bels (max)
1 Disk (500GB, 320GB, 250GB)	2.2 bels (typical) 2.4 bels (max)	2.4 bels (typical) 2.5 bels (max)

*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

2.10.1 Test for Prominent Discrete Tones (PDTs)

Seagate follows the ECMA-74 standards for measurement and identification of PDTs. An exception to this process is the use of the absolute threshold of hearing. Seagate uses this threshold curve (originated in ISO 389-7) to discern tone audibility and to compensate for the inaudible components of sound prior to computation of tone ratios according to Annex D of the ECMA-74 standards.

2.11 Electromagnetic immunity

When properly installed in a representative host system, the drive operates without errors or degradation in performance when subjected to the radio frequency (RF) environments defined in 8.

Table 8 Radio frequency environments

Test	Description	Performance level	Reference standard
Electrostatic discharge	Contact, HCP, VCP: ± 4 kV; Air: ± 8 kV	B	EN61000-4-2: 95
Radiated RF immunity	80MHz to 1,000MHz, 3 V/m, 80% AM with 1kHz sine 900MHz, 3 V/m, 50% pulse modulation @ 200Hz	A	EN61000-4-3: 96 ENV50204: 95
Electrical fast transient	± 1 kV on AC mains, ± 0.5 kV on external I/O	B	EN61000-4-4: 95
Surge immunity	± 1 kV differential, ± 2 kV common, AC mains	B	EN61000-4-5: 95
Conducted RF immunity	150kHz to 80MHz, 3 Vrms, 80% AM with 1kHz sine	A	EN61000-4-6: 97
Voltage dips, interrupts	0% open, 5 seconds 0% short, 5 seconds 40%, 0.10 seconds 70%, 0.01 seconds	C C C B	EN61000-4-11: 94

2.12 Reliability

2.12.1 Annualized Failure Rate (AFR)

The production disk drive shall achieve an annualized failure-rate of <1.0% over a 5 year service life when used in Desktop Storage field conditions as limited by the following:

- 2400 power-on-hours per year.
- Typical workload

Nonrecoverable read errors	1 per 10 ¹⁴ bits read, max
Rated Workload	Average annualized workload rating: <55 TB/year. The AFR specification for the product assumes the I/O workload does not exceed the average annualized workload rate limit of 55 TB/year. Workloads exceeding the annualized rate may degrade the product AFR and impact reliability as experienced by the particular application. The average annualized workload rate limit is in units of TB per calendar year.
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: http://www.seagate.com/support/warranty-and-replacements/ . From this page, click on the "Check to see if the drive is under Warranty" link. The following are required to be provided: the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.
Preventive maintenance	None required.

2.13 Warranty

To determine the warranty for a specific drive, use a web browser to access the following web page:
<http://www.seagate.com/support/warranty-and-replacements/>

From this page, click on "Check to see if the drive is under Warranty". Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.

2.14 Agency certification

2.14.1 Safety certification

These products are certified to meet the requirements of UL60950-1, CSA60950-1 and EN60950 and so marked as to the certify agency.

2.14.2 Electromagnetic compatibility

Hard drives that display the CE mark comply with the European Union (EU) requirements specified in the Electromagnetic Compatibility Directive (2004/108/EC) as put into place 20 July 2007. Testing is performed to the levels specified by the product standards for Information Technology Equipment (ITE). Emission levels are defined by EN 55022, Class B and the immunity levels are defined by EN 55024.

Drives are tested in representative end-user systems. Although CE-marked Seagate drives comply with the directives when used in the test systems, we cannot guarantee that all systems will comply with the directives. The drive is designed for operation inside a properly designed enclosure, with properly shielded I/O cable (if necessary) and terminators on all unused I/O ports. Computer manufacturers and system integrators should confirm EMC compliance and provide CE marking for their products.

Korean RRL

If these drives have the Korean Communications Commission (KCC) logo, they comply with paragraph 1 of Article 11 of the Electromagnetic Compatibility control Regulation and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Radio Research Laboratory (RRL) Communications Commission, Republic of Korea.

These drives have been tested and comply with the Electromagnetic Interference/Electromagnetic Susceptibility (EMI/EMS) for Class B products. Drives are tested in a representative, end-user system by a Korean-recognized lab.

- Family name: Barracuda
- Certificate number: KCC-REM-STX-Barracuda

Australian C-Tick (N176)

If these models have the C-Tick marking, they comply with the Australia/New Zealand Standard AS/NZ CISPR22 and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Australian Communication Authority (ACA).

2.14.3 FCC verification

These drives are intended to be contained solely within a personal computer or similar enclosure (not attached as an external device). As such, each drive is considered to be a subassembly even when it is individually marketed to the customer. As a subassembly, no Federal Communications Commission verification or certification of the device is required.

Seagate has tested this device in enclosures as described above to ensure that the total assembly (enclosure, disk drive, motherboard, power supply, etc.) does comply with the limits for a Class B computing device, pursuant to Subpart J, Part 15 of the FCC rules. Operation with non-certified assemblies is likely to result in interference to radio and television reception.

Radio and television interference. This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception.

This equipment is designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television, which can be determined by turning the equipment on and off, users are encouraged to try one or more of the following corrective measures:

- Reorient the receiving antenna.
- Move the device to one side or the other of the radio or TV.
- Move the device farther away from the radio or TV.
- Plug the computer into a different outlet so that the receiver and computer are on different branch outlets.

If necessary, users should consult the dealer or an experienced radio/television technician for additional suggestions. Users may find helpful the following booklet prepared by the Federal Communications Commission: *How to Identify and Resolve Radio-Television Interference Problems*. This booklet is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Refer to publication number 004-000-00345-4.

2.15 Environmental protection

Seagate designs its products to meet environmental protection requirements worldwide, including regulations restricting certain chemical substances.

2.15.1 European Union Restriction of Hazardous Substances (RoHS) Directive

The European Union Restriction of Hazardous Substances (RoHS) Directive, restricts the presence of chemical substances, including Lead, Cadmium, Mercury, Hexavalent Chromium, PBB and PBDE, in electronic products, effective July 2006. This drive is manufactured with components and materials that comply with the RoHS Directive.

2.15.2 China Restriction of Hazardous Substances (RoHS) Directive 中国限制危险物品的指令

This product has an Environmental Protection Use Period (EPUP) of 20 years. The following table contains information mandated by China's "Marking Requirements for Control of Pollution Caused by Electronic Information Products" Standard.



该产品具有20年的环境保护使用周期（EPUP）。下表包含了中国“电子产品所导致的污染的控制的记号要求”所指定的信息。

Name of Parts 部件名称	Toxic or Hazardous Substances or Elements 有毒有害物质或元素					
	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 镉 (Cd)	Hexavalent Chromium 六价铬 (Cr6+)	Polybrominated Diphenyl 多溴联苯 (PBB)	Polybrominated Diphenyl Ether 多溴二苯醚 (PBDE)
PCBA	X	O	O	O	O	O
HDA	X	O	O	O	O	O

"O" indicates the hazardous and toxic substance content of the part (at the homogeneous material level) is lower than the threshold defined by the China RoHS MCV Standard.

“O”表示该部件（于同类物品程度上）所含的危险和有毒物质低于中国RoHS MCV标准所定义的门槛值。

"X" indicates the hazardous and toxic substance content of the part (at the homogeneous material level) is over the threshold defined by the China RoHS MCV Standard.

“X”表示该部件（于同类物品程度上）所含的危险和有毒物质超出中国RoHS MCV标准所定义的门槛值。

2.16 Corrosive environment

Seagate electronic drive components pass accelerated corrosion testing equivalent to 10 years exposure to light industrial environments containing sulfurous gases, chlorine and nitric oxide, classes G and H per ASTM B845. However, this accelerated testing cannot duplicate every potential application environment. Users should use caution exposing any electronic components to uncontrolled chemical pollutants and corrosive chemicals as electronic drive component reliability can be affected by the installation environment. The silver, copper, nickel and gold films used in Seagate products are especially sensitive to the presence of sulfide, chloride, and nitrate contaminants. Sulfur is found to be the most damaging. In addition, electronic components should never be exposed to condensing water on the surface of the printed circuit board assembly (PCBA) or exposed to an ambient relative humidity greater than 95%. Materials used in cabinet fabrication, such as vulcanized rubber, that can outgas corrosive compounds should be minimized or eliminated. The useful life of any electronic equipment may be extended by replacing materials near circuitry with sulfide-free alternatives.

3.0 Configuring and Mounting the Drive

This section contains the specifications and instructions for configuring and mounting the drive.

3.1 Handling and static-discharge precautions

After unpacking, and before installation, the drive may be exposed to potential handling and electrostatic discharge (ESD) hazards. Observe the following standard handling and static-discharge precautions:

Caution

- Before handling the drive, put on a grounded wrist strap, or ground oneself frequently by touching the metal chassis of a computer that is plugged into a grounded outlet. Wear a grounded wrist strap throughout the entire installation procedure.
- Handle the drive by its edges or frame *only*.
- The drive is extremely fragile—handle it with care. Do not press down on the drive top cover.
- Always rest the drive on a padded, antistatic surface until mounting it in the computer.
- Do not touch the connector pins or the printed circuit board.
- Do not remove the factory-installed labels from the drive or cover them with additional labels. Removal voids the warranty. Some factory-installed labels contain information needed to service the drive. Other labels are used to seal out dirt and contamination.

3.2 Configuring the drive

Each drive on the SATA interface connects point-to-point with the SATA host adapter. There is no master/slave relationship because each drive is considered a master in a point-to-point relationship. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. Both drives behave as if they are Device 0 (master) devices.

SATA drives are designed for easy installation. It is usually not necessary to set any jumpers on the drive for proper operation; however, if users connect the drive and receive a “drive not detected” error, the SATA-equipped motherboard or host adapter may use a chipset that does not support SATA speed autonegotiation.

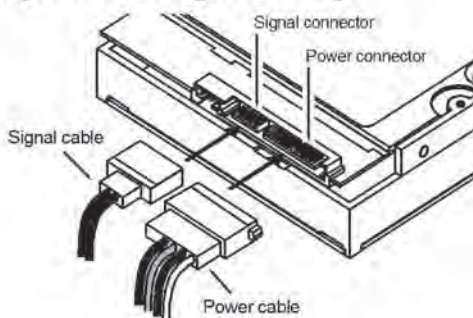
3.3 SATA cables and connectors

The SATA interface cable consists of four conductors in two differential pairs, plus three ground connections. The cable size may be 30 to 26 AWG with a maximum length of one meter (39.37 inches). See [Figure 9](#) for connector pin definitions. Either end of the SATA signal cable can be attached to the drive or host.

For direct backplane connection, the drive connectors are inserted directly into the host receptacle. The drive and the host receptacle incorporate features that enable the direct connection to be hot pluggable and blind mateable.

For installations which require cables, users can connect the drive as illustrated in [Figure 1](#).

Figure 1 Attaching SATA cabling



Each cable is keyed to ensure correct orientation. Desktop HDD drives support latching SATA connectors.

4.0 About (SED) Self-Encrypting Drives

Self-encrypting drives (SEDs) offer encryption and security services for the protection of stored data, commonly known as "data at rest". These drives are compliant with the Trusted Computing Group (TCG) Opal Storage Specifications as detailed in the following:

- TCG Storage Architecture Core Specification, Version 2.0 (see www.trustedcomputinggroup.org)
- TCG Storage Security Subsystem Class Opal Specification, Version 2.0 (see www.trustedcomputinggroup.org)

In case of conflict between this document and any referenced document, this document takes precedence.

The Trusted Computing Group (TCG) is a standards organization sponsored and operated by companies in the computer, storage and digital communications industry. Seagate's SED models comply with the standards published by the TCG.

To use the security features in the drive, the host must be capable of constructing and issuing the following two SATA commands:

- Trusted Send
- Trusted Receive

These commands are used to convey the TCG protocol to and from the drive in their command payloads. Seagate Secure SEDs also support TCG Single User Mode, which can be disabled.

4.1 Data Encryption

Encrypting drives use one inline encryption engine within each drive employing AES-256 algorithms in Cipher Block Chaining (CBC) mode to encrypt all data prior to being written on the media and to decrypt all data as it is read from the media. The encryption engine is always in operation and cannot be disabled. The 32-byte Data Encryption Key (DEK) is a random number which is generated by the drive, never leaves the drive, and is inaccessible to the host system. The DEK is itself encrypted when it is stored on the media and when in volatile temporary storage (DRAM), which is external to the encryption engine. A unique data encryption key is used for each of the drive's possible 16 data bands (see [Bands](#)).

4.2 Controlled Access

The drive has two security providers (SPs) called the "Admin SP" and the "Locking SP." These act as gatekeepers to the drive security services. Security-related commands will not be accepted unless the user provides the correct credentials to prove that they are authorized to perform the command.

4.2.1 Admin SP

The Admin SP allows the drive's owner to enable or disable firmware download operations (see [Locking](#)). Access to the Admin SP is available using the SID (Secure ID) password.

4.2.2 Locking SP

The Locking SP controls read/write access to the media and the cryptographic erase feature. Access to the Locking SP is available using the Admin or User passwords.

4.2.3 Default password

When the drive is shipped from the factory, all passwords are set to the value of MSID. This 32-byte random value can only be read by the host electronically over the interface. After receipt of the drive, it is the responsibility of the owner to use the default MSID password as the authority to change all other passwords to unique owner-specified values.

4.2.4 ATA Enhanced Security

The drive can utilize the system's BIOS through the ATASecurity API for cases that do not require password management and additional security policies.

Furthermore, the drive's ATASecurity Erase Unit command shall support both Normal and Enhanced Erase modes with the following modifications/additions:

Normal Erase: Normal erase feature shall be performed by changing the Data Encryption Key (DEK) of the drive, followed by an overwrite operation that repeatedly writes a single sector containing random data to the entire drive. This write operation bypasses the media encryption. On reading back the overwritten sectors, the host will receive a decrypted version, using the new DEK of the random data sector (the returned data will not match what was written).

Enhanced Erase: Enhanced erase shall be performed by changing the Data Encryption Key of the drive.

4.3 Random Number Generator (RNG)

The drive has a 32-byte hardware RNG that it uses to derive encryption keys or, if requested to do so, to provide random numbers to the host for system use, including using these numbers as Authentication Keys (passwords) for the drive's Admin and Locking SPs.

4.4 Drive Locking

In addition to changing the passwords, as described in [Section 4.3](#), the owner should also set the data access controls for the individual bands.

password, the owner should also set the data access

The variable "LockOnReset" should be set to "PowerCycle" to ensure that the data bands will be locked if power is lost. In addition "ReadLockEnabled" and "WriteLockEnabled" must be set to true in the locking table in order for the bands "LockOnReset" setting of "PowerCycle" to actually lock access to the band when a "PowerCycle" event occurs. This scenario occurs if the drive is removed from its cabinet. The drive will not honor any data read or write requests until the bands have been unlocked. This prevents the user data from being accessed without the appropriate credentials when the drive has been removed from its cabinet and installed in another system.

4.5 Data Bands

When shipped from the factory, the drive is configured with a single data band called Band 0 (also known as the Global Data Band) which comprises LBA 0 through LBA max. The host may allocate additional bands (Band1 to Band15) by specifying a start LBA and an LBA range. The real estate for this band is taken from the Global Band.

Data bands cannot overlap but they can be sequential with one band ending at LBA (x) and the next beginning at LBA (x+1).

Each data band has its own drive-generated encryption key. The host may change the Encryption Key (see [Section 4.6](#) Erase) or the password when required.

4.6 Cryptographic Erase

A valuable feature of SEDs is the ability to perform a cryptographic erase. This involves the host telling the drive to change the data encryption key for a particular band. Once changed, the data is no longer recoverable since it was written with one key and will be read using a different key. Since the drive overwrites the old key with the new one, and keeps no history of key the older key, the user data can never be recovered. This is done in a matter of seconds and is very useful if the drive is to be scrapped or repurposed.

4.7 Authenticated Firmware Download

In addition to providing a locking mechanism to prevent unwanted firmware download attempts, the drive also only accepts download files which have been cryptographically signed by the appropriate Seagate Design Center.

Three conditions must be met before the drive will allow the download operation:

1. The download must be an SED file. A standard drive (non-SED) file will be rejected.
2. The download file must be signed and authenticated.
3. As with a non-SED drive, the download file must pass the acceptance criteria for the drive. For example it must be applicable to the correct drive model, and have compatible revision and customer status.

4.8 Power Requirements

The standard drive models and the SED drive models have identical hardware, however the security and encryption portion of the drive controller ASIC is enabled and functional in the SED models. This represents a small additional drain on the 5V supply of about

30mA and a commensurate increase of about 150mW in power consumption. There is no additional drain on the 12V supply. See the tables in [Section 4.8](#) specifications for power requirements on the standard (non-SED) drive models.

4.9 Supported Commands

The SED models support the following two commands in addition to the commands supported by the standard (non-SED) models as listed in [Table 10](#):

- Trusted Send
- Trusted Receive

4.10 RevertSP

SED models will support the RevertSP feature which erases all data in all bands on the device and returns the contents of all SPs (Security Providers) on the device to their original factory state. In order to execute the RevertSP method the unique PSID (Physical Secure ID) printed on the drive label must be provided. PSID is not electronically accessible and can only be manually read from the drive label or scanned in via the 2D barcode.

5.0 SATAInterface

These drives use the industry-standard Serial ATA (SATA) interface that supports FIS data transfers. It supports ATA programmed input/output (PIO) modes 0 to 4; multiword DMA modes 0 to 2, and Ultra DMA modes 0 to 6.

For detailed information about the SATA interface, refer to the "Serial ATA: High Speed Serialized AT Attachment" specification.

5.1 Hot-Plug compatibility

Desktop HDD drives incorporate connectors which enable users to hot plug these drives in accordance with the SATA Revision 3.2 specification. This specification can be downloaded from www.serialata.org.

5.2 SATA device plug connector pin definitions

9 summarizes the signals on the SATA interface and power connectors.

Table 9 SATA connector pin definitions

Segment	Pin	Function	Definition
Signal	S1	Ground	2nd mate
	S2	A+	Differential signal pair A from Phy
	S3	A-	
	S4	Ground	2nd mate
	S5	B-	Differential signal pair B from Phy
	S6	B+	
	S7	Ground	2nd mate
Key and spacing separate signal and power segments			
Power	P1	V ₃₃	3.3V power
	P2	V ₃₃	3.3V power
	P3	V ₃₃	3.3V power, pre-charge, 2nd mate
	P4	Ground	1st mate
	P5	Ground	2nd mate
	P6	Ground	2nd mate
	P7	V ₅	5V power, pre-charge, 2nd mate
	P8	V ₅	5V power
	P9	V ₅	5V power
	P10	Ground	2nd mate
	P11	Ground or LED signal	If grounded, drive does not use deferred spin
	P12	Ground	1st mate
	P13	V ₁₂	12V power, pre-charge, 2nd mate
	P14	V ₁₂	12V power
	P15	V ₁₂	12V power

Notes

- All pins are in a single row, with a 1.27 mm (0.050 in) pitch.
- The comments on the mating sequence apply to the case of backplane blindmate connector only. In this case, the mating sequences are:
 - the ground pins P4 and P12.
 - the pre-charge power pins and the other ground pins.
 - the signal pins and the rest of the power pins.
- There are three power pins for each voltage. One pin from each voltage is used for pre-charge when installed in a blind-mate backplane configuration.
 - All used voltage pins (V_x) must be terminated.

5.3 Supported ATAcommands

The following table lists SATAstandard commands that the drive supports.

For a detailed description of the ATAcommands, refer to the Serial ATAInternational Organization: Serial ATARevision 3.0 (<http://www.sata-io.org>).

See "S.M.A.R.T. commands" on page 36 for details and subcommands used in the S.M.A.R.T. implementation.

Table 10 SATAstandard commands

Command name	Command code (in hex)
Check Power Mode	E5 _H
Device Configuration Freeze Lock	B1 _H / C1 _H
Device Configuration Identify	B1 _H / C2 _H
Device Configuration Restore	B1 _H / C0 _H
Device Configuration Set	B1 _H / C3 _H
Device Reset	08 _H
Download Microcode	92 _H
Execute Device Diagnostics	90 _H
Flush Cache	E7 _H
Flush Cache Extended	EA _H
Format Track	50 _H
Identify Device	EC _H
Idle	E3 _H
Idle Immediate	E1 _H
Initialize Device Parameters	91 _H
Read Buffer	E4 _H
Read DMA	C8 _H
Read DMA Extended	25 _H
Read DMA Without Retries	C9 _H
Read Log Ext	2F _H
Read Multiple	C4 _H
Read Multiple Extended	29 _H
Read Native Max Address	F8 _H
Read Native Max Address Extended	27 _H
Read Sectors	20 _H
Read Sectors Extended	24 _H
Read Sectors Without Retries	21 _H
Read Verify Sectors	40 _H
Read Verify Sectors Extended	42 _H
Read Verify Sectors Without Retries	41 _H
Recalibrate	10 _H
Security Disable Password	F6 _H
Security Erase Prepare	F3 _H
Security Erase Unit	F4 _H

Table 10 SATA standard commands (continued)

Command name	Command code (in hex)	
Security Freeze	F5 _H	
Security Set Password	F1 _H	
Security Unlock	F2 _H	
Seek	70 _H	
Set Features	EF _H	
Set Max Address	F9 _H	
Note: Individual Set Max Address commands are identified by the value placed in the Set Max Features register as defined to the right.	Address: Password: Lock: Unlock: Freeze Lock:	00 _H 01 _H 02 _H 03 _H 04 _H
Set Max Address Extended	37 _H	
Set Multiple Mode	C6 _H	
Sleep	E6 _H	
S.M.A.R.T. Disable Operations	B0 _H / D9 _H	
S.M.A.R.T. Enable/Disable Autosave	B0 _H / D2 _H	
S.M.A.R.T. Enable Operations	B0 _H / D8 _H	
S.M.A.R.T. Execute Offline	B0 _H / D4 _H	
S.M.A.R.T. Read Attribute Thresholds	B0 _H / D1 _H	
S.M.A.R.T. Read Data	B0 _H / D0 _H	
S.M.A.R.T. Read Log Sector	B0 _H / D5 _H	
S.M.A.R.T. Return Status	B0 _H / DA _H	
S.M.A.R.T. Save Attribute Values	B0 _H / D3 _H	
S.M.A.R.T. Write Log Sector	B0 _H / D6 _H	
Standby	E2 _H	
Standby Immediate	E0 _H	
Write Buffer	E8 _H	
Write DMA	CA _H	
Write DMA Extended	35 _H	
Write DMA FUA Extended	3D _H	
Write DMA Without Retries	CB _H	
Write Log Extended	3F _H	
Write Multiple	C5 _H	
Write Multiple Extended	39 _H	
Write Multiple FUA Extended	CE _H	
Write Sectors	30 _H	
Write Sectors Without Retries	31 _H	
Write Sectors Extended	34 _H	
Write Uncorrectable	45 _H	

5.3.1 Identify Device command

The Identify Device command (command code EC_H) transfers information about the drive to the host following power up. The data is organized as a single 512-byte block of data, whose contents are shown in on page 29. All reserved bits or words should be set to zero. Parameters listed with an "x" are drive-specific or vary with the state of the drive.

The following commands contain drive-specific features that may not be included in the SATA specification.

Table 11 Identify Device commands

Word	Description	Value
0	Configuration information: • Bit 15: 0 = ATA; 1 = ATAPI • Bit 7: removable media • Bit 6: removable controller • Bit 0: reserved	0C5A _H
1	Number of logical cylinders	16,383
2	ATA-reserved	0000 _H
3	Number of logical heads	16
4	Retired	0000 _H
5	Retired	0000 _H
6	Number of logical sectors per logical track: 63	003F _H
7–9	Retired	0000 _H
10–19	Serial number: (20 ASCII characters, 0000 _H = none)	ASCII
20	Retired	0000 _H
21	Retired	0400 _H
22	Obsolete	0000 _H
23–26	Firmware revision (8 ASCII character string, padded with blanks to end of string)	x.xx
27–46	Drive model number: (40 ASCII characters, padded with blanks to end of string)	
47	(Bits 7–0) Maximum sectors per interrupt on Read multiple and Write multiple (16)	8010 _H
48	Reserved	0000 _H
49	Standard Standby timer, ICRDY supported and may be disabled	2F00 _H
50	ATA-reserved	0000 _H
51	PIO data-transfer cycle timing mode	0200 _H
52	Retired	0200 _H
53	Words 54–58, 64–70 and 88 are valid	0007 _H
54	Number of current logical cylinders	xxxx _H
55	Number of current logical heads	xxxx _H
56	Number of current logical sectors per logical track	xxxx _H
57–58	Current capacity in sectors	xxxx _H
59	Number of sectors transferred during a Read Multiple or Write Multiple command	xxxx _H

Table 11 Identify Device commands (continued)

Word	Description	Value
60–61	Total number of user-addressable LBA sectors available (see Section 2.2 for related information) *Note: The maximum value allowed in this field is: 0FFFFFFFh (268,435,455 sectors, 137GB). Drives with capacities over 137GB will have 0FFFFFFFh in this field and the actual number of user-addressable LBAs specified in words 100–103. This is required for drives that support the 48-bit addressing feature.	0FFFFFFFh*
62	Retired	0000 _H
63	Multiword DMA active and modes supported (see note following this table)	xx07 _H
64	Advanced PIO modes supported (modes 3 and 4 supported)	0003 _H
65	Minimum multiword DMA transfer cycle time per word (120 nsec)	0078 _H
66	Recommended multiword DMA transfer cycle time per word (120 nsec)	0078 _H
67	Minimum PIO cycle time without IORDY flow control (240 nsec)	0078 _H
68	Minimum PIO cycle time with IORDY flow control (120 nsec)	0078 _H
69–74	ATA-reserved	0000 _H
75	Queue depth	001F _H
76	SATA capabilities	xxxx _H
77	Reserved for future SATA definition	xxxx _H
78	SATA features supported	xxxx _H
79	SATA features enabled	xxxx _H
80	Major version number	01F0 _H
81	Minor version number	0028 _H
82	Command sets supported	364B _H
83	Command sets supported	7F09 _H
84	Command sets support extension (see note following this table)	4163 _H
85	Command sets enabled	30xx _H
86	Command sets enabled	BE09 _H
87	Command sets enable extension	4163 _H
88	Ultra DMA support and current mode (see note following this table)	xx7F _H
89	Security erase time	0039 _H
90	Enhanced security erase time	0039 _H
92	Master password revision code	FFFE _H
93	Hardware reset value	xxxx _H
94	Automatic acoustic management	8080 _H
95–99	ATA-reserved	0000 _H

Table 11 Identify Device commands (continued)

Word	Description	Value
100–103	Total number of user-addressable LBA sectors available (see Section 2.2 for related information). These words are required for drives that support the 48-bit addressing feature. Maximum value: 0000FFFFFFFFh.	ST3000DM001 = 5,860,533,168 ST3000DM002 = 5,860,533,168 ST2000DM001 = 3,907,029,168 ST2000DM002 = 3,907,029,168 ST1500DM003 = 2,930,277,168 ST1000DM003 = 1,953,525,168 ST1000DM004 = 1,953,525,168 ST750DM003 = 1,465,149,168 ST500DM002 = 976,773,168 ST320DM000 = 625,142,448 ST250DM000 = 488,397,168
104–107	ATA-reserved	0000 _H
108–111	The mandatory value of the world wide name (WWN) for the drive. NOTE: This field is valid if word 84, bit 8 is set to 1 indicating 64-bit WWN support.	Each drive will have a unique value.
112–127	ATA-reserved	0000 _H
128	Security status	0001 _H
129–159	Seagate-reserved	xxx _H
160–254	ATA-reserved	0000 _H
255	Integrity word	xxA5 _H

Note

Advanced Power Management (APM) and Automatic Acoustic Management (AAM) features are not supported.

Note

See the bit descriptions below for words 63, 84, and 88 of the Identify Drive data.

Description (if bit is set to 1)		
	Bit	Word 63
	0	Multiword DMA mode 0 is supported.
	1	Multiword DMA mode 1 is supported.
	2	Multiword DMA mode 2 is supported.
	8	Multiword DMA mode 0 is currently active.
	9	Multiword DMA mode 1 is currently active.
	10	Multiword DMA mode 2 is currently active.
	Bit	Word 84
	0	SMART error login is supported.
	1	SMART self-test is supported.
	2	Media serial number is supported.
	3	Media Card Pass Through Command feature set is supported.
	4	Streaming feature set is supported.
	5	GPL feature set is supported.

	6	WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands are supported.
	7	WRITE DMA QUEUED FUA EXT command is supported.
	8	64-bit World Wide Name is supported.
	9-10	Obsolete.
	11-12	Reserved for TLC.
	13	IDLE IMMEDIATE command with IUNLOAD feature is supported.
	14	Shall be set to 1.
	15	Shall be cleared to 0.
	Bit	Word 88
	0	Ultra DMA mode 0 is supported.
	1	Ultra DMA mode 1 is supported.
	2	Ultra DMA mode 2 is supported.
	3	Ultra DMA mode 3 is supported.
	4	Ultra DMA mode 4 is supported.
	5	Ultra DMA mode 5 is supported.
	6	Ultra DMA mode 6 is supported.
	8	Ultra DMA mode 0 is currently active.
	9	Ultra DMA mode 1 is currently active.
	10	Ultra DMA mode 2 is currently active.
	11	Ultra DMA mode 3 is currently active.
	12	Ultra DMA mode 4 is currently active.
	13	Ultra DMA mode 5 is currently active.
	14	Ultra DMA mode 6 is currently active.

5.3.2 Set Features command

This command controls the implementation of various features that the drive supports. When the drive receives this command, it sets BSY, checks the contents of the Features register, clears BSY and generates an interrupt. If the value in the register does not represent a feature that the drive supports, the command is aborted. Power-on default has the read look-ahead and write caching features enabled. The acceptable values for the Features register are defined as follows:

Table 12 Set Features command

02 _H	Enable write cache (<i>default</i>).
03 _H	Set transfer mode (based on value in Sector Count register). Sector Count register values:
00 _H	Set PIO mode to default (PIO mode 2).
01 _H	Set PIO mode to default and disable IORDY (PIO mode 2).
08 _H	PIO mode 0
09 _H	PIO mode 1
0A _H	PIO mode 2
0B _H	PIO mode 3
0C _H	PIO mode 4 (<i>default</i>)
20 _H	Multiword DMA mode 0
21 _H	Multiword DMA mode 1
22 _H	Multiword DMA mode 2
40 _H	Ultra DMA mode 0
41 _H	Ultra DMA mode 1
42 _H	Ultra DMA mode 2
43 _H	Ultra DMA mode 3
44 _H	Ultra DMA mode 4
45 _H	Ultra DMA mode 5
46 _H	Ultra DMA mode 6
10 _H	Enable use of SATA features
55 _H	Disable read look-ahead (read cache) feature.
82 _H	Disable write cache
90 _H	Disable use of SATA features
AA _H	Enable read look-ahead (read cache) feature (<i>default</i>).
F1 _H	Report full capacity available

Note

At power-on, or after a hardware or software reset, the default values of the features are as indicated above.

5.3.3 S.M.A.R.T.commands

S.M.A.R.T. provides near-term failure prediction for disk drives. When S.M.A.R.T. is enabled, the drive monitors predetermined drive attributes that are susceptible to degradation over time. If self-monitoring determines that a failure is likely, S.M.A.R.T. makes a status report available to the host. Not all failures are predictable. S.M.A.R.T. predictability is limited to the attributes the drive can monitor. For more information on S.M.A.R.T. commands and implementation, see the *Draft ATA-5 Standard*.

SeaTools diagnostic software activates a built-in drive self-test (DST S.M.A.R.T. command for D4_H) that eliminates unnecessary drive returns. The diagnostic software ships with all new drives and is also available at: <http://seatools.seagate.com>.

This drive is shipped with S.M.A.R.T. features disabled. Users must have a recent BIOS or software package that supports S.M.A.R.T. to enable this feature. The table below shows the S.M.A.R.T. command codes that the drive uses.

Table 13 S.M.A.R.T.commands

Code in features register	S.M.A.R.T.command
D0 _H	S.M.A.R.T.Read Data
D2 _H	S.M.A.R.T.Enable/Disable Attribute Autosave
D3 _H	S.M.A.R.T.Save Attribute Values
D4 _H	S.M.A.R.T.Execute Off-line Immediate (runs DST)
D5 _H	S.M.A.R.T.Read Log Sector
D6 _H	S.M.A.R.T.Write Log Sector
D8 _H	S.M.A.R.T.Enable Operations
D9 _H	S.M.A.R.T.Disable Operations
DA _H	S.M.A.R.T.Return Status

Note

If an appropriate code is not written to the Features Register, the command is aborted and 0x04 (abort) is written to the Error register.



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September 2015*

EXHIBIT 20

From: Mark W Hall <mark.w.hall@seagate.com>
Sent: Friday, February 28, 2014 2:48 PM
To: Mary Shartle <mary.m.shartle@seagate.com>
Cc: Barbara J Craig <barbara.j.craig@seagate.com>; Aubrey Muhlach <aubrey.muhlach@seagate.com>; Teresa Nykilchuk <teresa.nykilchuk@seagate.com>; Joshua Walti <joshua.walti@seagate.com>; Joanne Chan <joanne.chan@seagate.com>; Joni J Clark <joni.j.clark@seagate.com>; Jennifer L Bradfield <jennifer.l.bradfield@seagate.com>
Subject: Re: REMINDER INPUT NEEDED: It's Time to Update the Storage Solutions Guide!
Attach: SSG1351.14-1310US_October2013 (M Hall Edits 2-28-14).pdf

Mary, updates attached. Primarily 600 and 600 Pro SSD have been EOL'd so need to be edited out. If you need more fodder to fill the page for for the 1200 I can come up with some.

Best regards,
Mark W. Hall
Sr. Marketing Manager, Flash Portfolio
Global Marketing

Seagate Technology – MS: SHK202 – 1280 Disc Drive – Shakopee, MN 55379

Cell: 612-244-5466
Office: 952-402-2987

On Thu, Feb 27, 2014 at 3:57 PM, Mary Shartle <mary.m.shartle@seagate.com> wrote:

Hello Product Marketing,

Just a reminder that your edits to the Storage Solution Guide are due by end of business **tomorrow, Friday2/28.**

Thanks,
Mary

What I need from you:

- Download the attached pdf and review the entire document (Table of Contents, At-a-Glance Product Comparisons, individual product intros and product features).

- Use the editing tools to markup the document with your requested changes. This document will launch on 4/1. Keep that date in mind while making your changes.
- Return the document to me. I'll consolidate all of your requested edits and work with Tom McCall's team on production.
- Your changes are due to me prior to **Friday, February 28th.**

On Wed, Feb 19, 2014 at 1:21 PM, Mary Shartle <mary.m.shartle@seagate.com> wrote:

Hello Product Marketing Managers,

The Storage Solutions Guide is a valuable tool that is frequently downloaded and referenced. It has not been updated since October and many of us are fielding requests for an updated guide.

I need your help in order to ensure that we're communicating accurate information to our customers.

What I need from you:

- Download the attached pdf and review the entire document (Table of Contents, At-a-Glance Product Comparisons, individual product intros and product features).
- Use the editing tools to markup the document with your requested changes. This document will launch on 4/1. Keep that date in mind while making your changes.
- Return the document to me. I'll consolidate all of your requested edits and work with Tom McCall's team on production.
- Your changes are due to me prior to **Friday, February 28th.**

Thanks in advance for your help. Please let me know if you have questions.

Best,
Mary



Storage Solutions Guide

OCTOBER 2013 | AMER

ROOM TO GROW

Double the storage.
Half the space.



New 8-Bay Rackmount NAS

The first 1U rack that
fits 8× 3.5" drives

Make the perfect gift complete.



Complete your tablet with
1TB of storage to carry and stream 500+
movies or thousands of songs.
No internet required.



Wireless Plus
Mobile Device Storage



www.seagate.com

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External Storage

At-a-Glance Product Comparison







AT-A-GLANCE PRODUCT COMPARISON

	BACKUP PLUS					SLIM		EXPANSION		
Direct Attached/ Portable										
	Backup Plus Portable	Backup Plus Portable for Mac	Backup Plus for Mac Portable Thunderbolt™	Backup Plus Desktop	Backup Plus Desktop for Mac	Backup Plus for Mac Desktop Thunderbolt	Slim Portable	Slim Portable for Mac	Expansion Portable	Expansion Desktop
PERFECT FOR	Protecting and sharing digital memories			Keeping your digital life safe and sound		Keeping your digital life safe and sound	Thin storage that fits—and goes—anywhere		Protecting and sharing your digital life	
DESCRIPTION	Store and back up the content on your social networks with these flexible, portable drives. PC or Mac.			These desktop drives provide the simple, one-click way to protect and share files. PC or Mac.		These desktop drives provide the simple, one-click way to protect and share files. Mac.	This ultra-thin metal design is the world's sleekest portable external hard drive. PC or Mac.		Expansion drives allow you to instantly add more storage space to your computer and take large files with you.	
LEARN MORE	Page 5	Page 6	Page 6	Page 6	Page 7	Page 7	Page 9	Page 8	Page 10	Page 9

Wireless Mobile

	
	Wireless Plus
PERFECT FOR	Wireless storage for your tablet
DESCRIPTION	Take your media library on the go and stream it wirelessly to your iPad, Android tablet and smartphone. PC or Mac.
LEARN MORE	Page 10

Network Attached

						
	Business Storage 8-Bay Rackmount NAS	Business Storage 4-Bay Rackmount NAS	Business Storage 4-Bay NAS	Business Storage 4-Bay NAS	Business Storage 2-Bay NAS	Central
PERFECT FOR	Centralized storage and backup		Centralized storage, collaboration and backup			Wireless centralized home storage
DESCRIPTION	The first 1U rack that fits eight hot-swappable 3.5-inch drives	A complete, high-performance network storage for businesses with up to 100 employees	A complete network storage solution and private cloud for businesses of up to 50 employees.	A complete network storage solution and private cloud for businesses of up to 25 employees.	A complete network storage solution and private cloud for home offices.	This shared storage device automatically backs up multiple Macs and PCs plus streams your shared library to the connected devices in the home.
LEARN MORE	Page 11	Page 12	Page 12	Page 13	Page 13	Page 11

External Storage Solutions

Seagate external storage solutions are sleek, dependable and ultra-portable products that let your customers automatically and continuously store digital family photos, protect critical business data, back up multiple computers on a small network, or share and store videos and music.

EXTERNAL STORAGE

Backup Plus

The Backup Plus portable drive is the simple way to protect and share your entire digital life.

Key Advantages

- Easy, flexible backups
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click
- Thunderbolt technology or FireWire 800 upgrade allows higher transfer speeds

Best-Fit Applications

- Store or back up photos, movies, music and documents
- Download and save content that's posted on your social networks
- Share your digital memories to your social networks with a click

CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
1TB	STBU1000100	USB 3.0	● Black	PC, Mac
1TB	STBU1000101	USB 3.0	● Silver	PC, Mac
1TB	STBU1000102	USB 3.0	● Blue	PC, Mac
1TB	STBU1000103	USB 3.0	● Red	PC, Mac
750GB	STBU750100	USB 3.0	● Black	PC, Mac
PRODUCT DIMENSIONS	4.86-in L x 3.19-in W x 0.57-in D (123.4mm x 81.1mm x 14.5mm)			
PACKAGE DIMENSIONS	5.2-in L x 1.81-in W x 6.54-in D (132mm x 46mm x 166mm)			



¹ One gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes (depending on how you define it). GB/s is a measure of transfer speed.

STORAGE SOLUTIONS GUIDE 5

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CONFIDENTIAL

Backup Plus for Mac

The Backup Plus portable drive for Mac is the simple way to protect and share your entire digital life.

Key Advantages

- Mac OS and Time-Machine ready out of the box
- Automatically saves photos from social networks
- Share photos and video to social networks with a click
- Easily increase transfer speeds by upgrading to Thunderbolt technology

Best-Fit Applications

- Store or back up photos, movies, music, and documents
- Download and save content that's posted on your social networks
- Share your digital memories to your social networks with a click



CAPACITY	ITEM NUMBER	INTERFACE	COLOR	OS
1TB	STBW1000000	USB 3.0	● Silver ○ White	Mac, PC
PRODUCT DIMENSIONS	4.86-in L x 3.19-in W x 0.57-in D (123.4mm x 81.3mm x 14.5mm)			
PRODUCT DIMENSIONS	5.2-in L x 1.81-in W x 0.54-in D (133mm x 46mm x 13.8mm)			

Backup Plus Desktop for Mac

The Backup Plus desktop drive for Mac is the simple, one-click way to protect and share your entire digital life.

Key Advantages

- Mac OS and Time Machine ready right out of the box
- Automatically saves photos from social networks
- Share photos and video to social networks with a click
- Up to 3TB capacity for a lifetime of memories

Best-Fit Applications

- Back up all your important files
- Download and save content that's posted on your social networks
- Share your digital memories to your social networks with a click



CAPACITY	ITEM NUMBER	INTERFACE	COLOR	OS
4TB	STDB4000001	USB 3.0	● Back/ Silver	Mac, PC
2TB	STDB3000000	USB 3.0	● Back/ Silver	Mac, PC
3TB	STDB3000000	USB 3.0	● Back/ Silver	Mac, PC
PRODUCT DIMENSIONS	6.22-in L x 4.88-in W x 1.73-in D (158mm x 124mm x 44mm)			
PRODUCT DIMENSIONS	7.87-in L x 9.06-in W x 3.54-in D (200mm x 230mm x 90mm)			

Backup Plus for Mac Portable Thunderbolt™

The Thunderbolt Backup Plus for Mac portable drive is everything you need to transfer, store and back up files using Thunderbolt technology.

Key Advantages

- Includes Thunderbolt cable, adapter and drive
- Compatible with Time Machine software
- Compatible with Thunderbolt devices
- No external power supply required

Best-Fit Applications

- Combine high-speed data transfer and high-definition display in a single interface
- Unleash your creativity using high-bandwidth media-capturing devices while processing in real time
- Handle vast amounts of data more precisely than with any other connection
- Back up and restore data at 10Gbps



CAPACITY	ITEM NUMBER	INTERFACE	COLOR	OS
1TB	STBW1000401	Thunderbolt	● Black	Mac, PC
PRODUCT DIMENSIONS	5.12-in L x 3.19-in W x 1.09-in D (130mm x 81mm x 27.8mm)			
PRODUCT DIMENSIONS	6.69-in L x 5.24-in W x 1.81-in D (170mm x 133mm x 46mm)			

Backup Plus for Mac Desktop Thunderbolt

The Thunderbolt Backup Plus for Mac desktop drive is everything you need to transfer, store and back up files using Thunderbolt technology.

Key Advantages

- Includes Thunderbolt cable, adapter and drive
- Dual ports enable daisy-chaining up to six devices
- Compatible with Thunderbolt displays and other devices
- Compatible with Time Machine software

Best-Fit Applications

- Combine high-speed data transfer and high-definition display in a single interface
- Unleash your creativity using high-bandwidth media-capturing devices while processing in real time
- Handle vast amounts of data more precisely than with any other connection
- Back up and restore data at 10Gbps



CAPACITY	ITEM NUMBER	INTERFACE	COLOR	OS
3TB	STDB3000400	Thunderbolt	● Black	Mac, PC
PRODUCT DIMENSIONS	6.61-in L x 4.78-in W x 2.42-in D (168mm x 120.9mm x 61.4mm)			
PRODUCT DIMENSIONS	8.64-in L x 9.13-in W x 3.5-in D (219.5mm x 232mm x 89mm)			

Backup Plus Desktop

The Backup Plus desktop drive is the simple, one-click way to protect and share your entire digital life.

Key Advantages

- Easy, flexible, built-in backup options
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click.
- Up to 4TB capacity for a lifetime of memories
- Increase transfer speeds by upgrading to Thunderbolt technology or FireWire 800.

Best-Fit Applications

- Back up all your important files.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
1TB	STCA4000100	USB 3.0	● Black	PC, Mac
3TB	STCA3000101	USB 3.0	● Black	PC, Mac
5TB	STCA5000100	USB 3.0	● Black	PC, Mac
7TB	STCA7000100	USB 3.0	● Black	PC, Mac
PRODUCT DIMENSIONS	6.22-in L x 4.88-in W x 1.73-in D (158mm x 124mm x 44mm)			
PRODUCT WEIGHT	7.87-in L x 9.06-in W x 3.54-in D (200mm x 230mm x 90mm)			

Slim

The Seagate Slim portable drive is thin, light and the easiest way yet to back up the things that are important to you.

Key Advantages

- Just slightly thicker than an iPhone
- Protects your stuff with easy, flexible backups
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click.

Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
500GB	STC6500100	USB 3.0	● Black	PC, Mac
500GB	STC6500104	USB 3.0	● Silver	PC, Mac
PRODUCT DIMENSIONS	4.47-in L x 2.99-in W x 0.38-in D (113.5mm x 76mm x 9.6mm)			
PRODUCT WEIGHT	5.59-in L x 1.22-in W x 4.06-in D (143mm x 31mm x 103mm)			

Slim for Mac

The Seagate Slim portable drive for Mac combines a thin, light form factor in a Time Machine-ready drive.

Key Advantages

- Just slightly thicker than an iPhone
- Mac OS and Time Machine ready out of the box
- Automatically saves photos from social networks
- Photos and videos can be shared to social networks with a click.

Best-Fit Applications

- Store or back up photos, movies, music and documents.
- Download and save content that's posted on your social networks.
- Share your digital memories to your social networks with a click.



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
500GB	STC5500102	USB 3.0	● Silver	Mac, PC
PRODUCT DIMENSIONS	4.47-in L x 2.99-in W x 0.38-in D (113.5mm x 76mm x 9.6mm)			
PRODUCT WEIGHT	5.59-in L x 1.22-in W x 4.06-in D (143mm x 31mm x 103mm)			

Expansion

The Expansion desktop drive provides extra storage for your ever-growing collection of files.

Key Advantages

- Simple and straightforward setup
- No software to install and nothing to configure
- Saving files is easy—simply drag and drop.
- USB 3.0 interface allows fast transfer speeds.

Best-Fit Applications

- Instantly add more storage space to your computer.
- Improve performance on your computer's internal drive by freeing up space on your internal drive.



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
1TB	STB44000100	USB 3.0	● Black	PC
3TB	STB40000100	USB 3.0	● Black	PC
5TB	STB42000100	USB 3.0	● Black	PC
7TB	STB44000100	USB 3.0	● Black	PC
PRODUCT DIMENSIONS	7.07-in L x 4.65-in W x 1.48-in D (179.5mm x 119mm x 37.5mm)			
PRODUCT WEIGHT	9.09-in L x 7.87-in W x 2.83-in D (231mm x 200mm x 72mm)			

Expansion

The Expansion portable drive is compact and perfect for taking large files with you on-the-go.

Key Advantages

- Simple and straightforward setup
- Powered from the USB cable
- Saving files is easy—simply drag and drop.
- USB 3.0 interface allows fast transfer speeds.

Best-Fit Applications

- Instantly add more storage space to your computer.
- Take large files with you when you travel.



CAPACITY	ST NUMBER	INTERFACE	COLOR	OS
1TB	STBX1000101	USB 3.0	● Black	PC, Mac
750GB	STBX0750100	USB 3.0	● Black	PC, Mac
500GB	STBX0500100	USB 3.0	● Black	PC, Mac
PRODUCT DIMENSIONS (HxWxD)	5.04-in L x 3.51-in W x 0.87-in D (128.1mm x 89.1mm x 22mm)			
PRODUCT DIMENSIONS (HxWxD)	4.81-in L x 3.19-in W x 0.61-in D (122.3mm x 81.1mm x 15.5mm)			
PRODUCT DIMENSIONS (HxWxD)	5.28-in L x 6.69-in W x 1.89-in D (134mm x 170mm x 48mm)			

Central


The Central shared network storage system allows you to create secure in-home cloud storage for multiple computers in the home.

Key Advantages

- Automatically back up multiple PC and Mac computers
- Wirelessly stream your centralized media library to gaming consoles, media players and smart TVs
- Access content on-the-go with a Web browser or the free app for tablets and smartphones

Best-Fit Applications

- Consolidate content on one easily accessible device
- Back up multiple PC and Mac computers
- Enjoy a centralized media library on smart TVs, game consoles and media players
- Access your content on-the-go with laptops and mobile devices
- Archive your Facebook photos and videos



CAPACITY	ST NUMBER	INTERFACE	COLOR	OS
4TB	STCG4000100	SATA6Gb/s	● Black	PC, Mac
8TB	STCG8000100	SATA6Gb/s	● Black	PC, Mac
2TB	STCG2000100	SATA6Gb/s	● Black	PC, Mac
PRODUCT DIMENSIONS (HxWxD)	5.7-in L x 8.5-in W x 1.7-in D (145mm x 216mm x 43mm)			
PRODUCT DIMENSIONS (HxWxD)	3.15-in L x 10.3-in W x 9.25-in D (80mm x 263mm x 235mm)			

Wireless Plus


With Wireless Plus mobile device storage, you can take your media library with you. Stream it to your iPad or Android tablet.

Key Advantages

- Take your media library with you on the go
- Share media with up to eight Wi-Fi enabled devices at the same time
- Use anywhere, without an Internet connection
- Up to 10 hours battery life¹

Best-Fit Applications

- Store and carry movies and other media on the go
- Share media with others
- Works with iPad or Android tablets and smartphones



CAPACITY	ST NUMBER	INTERFACE	COLOR	OS
1TB	STCK1000100	USB 3.0	● Grey	PC, Mac
PRODUCT DIMENSIONS (HxWxD)	5.00-in L x 3.50-in W x 0.79-in D (127mm x 89mm x 19.9mm)			
PRODUCT DIMENSIONS (HxWxD)	2.00-in L x 6.00-in W x 7.16-in D (51mm x 152mm x 183mm)			

Business Storage 8-Bay Rackmount NAS

A complete network storage solution with innovative 8-bay design in a 1U form factor that is perfect for growing businesses

Key Advantages

- A 2.3GHz dual-core Intel processor delivers file transfer performance of up to 200MB/s
- Wuota™ cloud service and apps for secure collaboration and anywhere access
- Centralized backup for PCs, plus Time Machine support for Mac computers
- Support for iSCSI enables maximum performance and compatibility for virtualized environments

Best-Fit Applications

- Store business-critical files centrally and securely
- Back up your organization's PC and Mac computers
- Access and manage files remotely using Internet-connected computers and devices
- Back up files to the cloud



CAPACITY	ST NUMBER	INTERFACE	COLOR	OS
32TB	STDP32000100	Gigabit Ethernet	Black	PC, Mac
24TB	STDP24000100	Gigabit Ethernet	Black	PC, Mac
16TB	STDP16000100	Gigabit Ethernet	Black	PC, Mac
12TB	STDP12000100	Gigabit Ethernet	Black	PC, Mac
8TB	STDP8000100	Gigabit Ethernet	Black	PC, Mac
PRODUCT DIMENSIONS (HxWxD)	30.394-in L x 17.13-in W x 18.78-in D (772mm x 435mm x 477mm)			
PRODUCT DIMENSIONS (HxWxD)	35.394-in L x 23.465-in W x 8.661-in D (899mm x 596mm x 220mm)			

Business Storage 4-Bay Rackmount NAS

Centralize your storage and backups with a complete network storage solution that saves valuable floor space for small businesses.

Key Advantages

- Centralized storage and backup for PCs and Macs, plus secure Wuala cloud off-site backup service
- A dual-core Intel Atom processor and new, performance-optimized Seagate NAS OS deliver file transfer speeds up to 200MB/s
- Anywhere access to your files
- Hot-swappable drives and dual Gigabit Ethernet ports help increase up-time

Best-Fit Applications

- Store business-critical files centrally and securely
- Back up your organization's PC and Mac computers
- Access and manage files remotely using Internet-connected computers and devices
- Back up files to the cloud



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
16TB	STBN16000100	Gigabit Ethernet	Black	PC, Mac
12TB	STBN12000100	Gigabit Ethernet	Black	PC, Mac
8TB	STBN8000100	Gigabit Ethernet	Black	PC, Mac
4TB	STBN4000100	Gigabit Ethernet	Black	PC, Mac
—	STBN100	Gigabit Ethernet	Black	PC, Mac
HEIGHT (DIN SPEC)	16.929-in L x 15-in W x 1.713-in D (430mm x 381mm x 42.5mm)			
POWERS (DIN SPEC)	22.44-in L x 10.967-in W x 8.496-in D (570mm x 277mm x 165mm)			

Business Storage 2-Bay NAS

Create a private cloud to help protect your business-critical data and centralize files in a single location you can access from anywhere.

Key Advantages

- Easy 10-minute setup
- Upload and download files with free apps for iPhone, iPad and Android devices
- Full-system, automatic backup for PCs, plus Time Machine support for Mac computers
- Customize performance and data redundancy with RAID 0 and 1 configuration options

Best-Fit Applications

- Make automatic, continuous backups of multiple PC and Mac computers
- Store files in a secure, central location
- Access and manage files remotely using Internet-connected computers, tablets and smartphones
- Create cost-effective, private cloud storage



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
8TB	STBN8000100	Gigabit Ethernet	Black	PC, Mac
4TB	STBN4000100	Gigabit Ethernet	Black	PC, Mac
2TB	STBN2000100	Gigabit Ethernet	Black	PC, Mac
—	STBN100	Gigabit Ethernet	Black	PC, Mac
HEIGHT (DIN SPEC)	4.1-in W x 8.0-in H x 6.9-in D (104.50mm x 204.00mm x 227.00mm)			
POWERS (DIN SPEC)	6.2-in W x 10.9-in H x 12.5-in D (157.00mm x 277.00mm x 317.00mm)			

Business Storage 4-Bay NAS

A complete, small-business-specific network storage solution designed to provide optimum uptime and data integrity for up to 50 workstations.

Key Advantages

- Easy 10-minute setup
- Upload and download files with free apps for iPhone, iPad and Android devices
- Full-system, automatic backup for PCs, plus Time Machine support for Mac computers
- Customize performance and data redundancy with RAID 0, 1, 5 and 10 configuration options

Best-Fit Applications

- Make automatic, continuous backups
- Store files in a secure, central location
- Access and manage files remotely using Internet-connected devices
- Create cost-effective, private cloud storage
- Encrypt individual files to entire volumes of data



CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
16TB	STBN16000100	Gigabit Ethernet	Black	PC, Mac
12TB	STBN12000100	Gigabit Ethernet	Black	PC, Mac
8TB	STBN8000100	Gigabit Ethernet	Black	PC, Mac
4TB	STBN4000100	Gigabit Ethernet	Black	PC, Mac
—	STBN100	Gigabit Ethernet	Black	PC, Mac
HEIGHT (DIN SPEC)	6.3-in W x 8.2-in H x 10.2-in D (161.00mm x 206.00mm x 259.50mm)			
POWERS (DIN SPEC)	8.4-in W x 14.9-in H x 9.4-in D (214.00mm x 379.00mm x 240.00mm)			

Business Storage 1-Bay NAS

Create a private cloud with Seagate Business Storage 1-Bay NAS. It helps protect your all-important data and centralizes your files in a single location you can access from anywhere.

Key Advantages

- Easy 10-minute setup
- Upload and download files with free apps for iPhone, iPad and Android devices
- Full-system, automatic backup for PCs, plus Time Machine support for Mac computers
- Stream your media library to networked computers, Internet TVs, game consoles and more

Best-Fit Applications

- Make automatic, continuous backups of multiple PC and Mac computers
- Store files in a secure, central location
- Access and manage files remotely using Internet-connected computers, tablets and smartphones
- Create cost-effective, private cloud storage























CAPACITY	KIT NUMBER	INTERFACE	COLOR	OS
1TB	STBN1000100	Gigabit Ethernet	Black	PC, Mac
3TB	STBN3000100	Gigabit Ethernet	Black	PC, Mac
5TB	STBN5000100	Gigabit Ethernet	Black	PC, Mac
HEIGHT (DIN SPEC)	2.4-in W x 6.9-in H x 5.6-in D (61mm x 176mm x 140mm)			
POWERS (DIN SPEC)	3.7-in W x 9.3-in H x 9.0-in D (93mm x 236mm x 229mm)			

AT-A-GLANCE PRODUCT COMPARISON

Internal Storage

At-a-Glance Product Comparison

	ENTERPRISE				DESKTOP		SPECIALTY	
3.5-inch								
	CloudReady 15K	Enterprise Capacity 3.5 HDD	Exos X1 HDD	Desktop HDD	Desktop HDD	NAS HDD	SVS Series HDD	Video 3.5 HDD
USE THIS DRIVE FOR	High-capacity, compute-intensive requirements demanding high performance and availability	Bulk-data applications requiring reliable, highest-capacity storage efficiency and enterprise-class reliability	Cost-effective, low-power bulk storage solutions for unstructured data	Desktop solutions requiring SSD-like performance and massive capacities at an affordable price	Desktop compute where choice in capacity and cache options to provide design flexibility is important	Small NAS systems needing performance with high capacities, 3-year limited warranty	Surveillance systems that require high performance, low power and centralized storage or every surveillance application, 3-year limited warranty	DVR systems where reliable, low-power, purpose-built storage is required for video streaming applications, 3-year limited warranty
ENCRYPTION MODELS AVAILABLE	X	X						
LEARN MORE	Page 25	Page 26	Page 28	Page 32	Page 32	Page 42	Page 42	Page 43

	EOL'd Products			ENTERPRISE SSD		ENTERPRISE		MOBILE			SPECIALTY	
2.5-inch												
	1200 SSD	600 P40 SSD	800 V40 SSD	Enterprise Turbo SSD	Enterprise Performance 15K HDD	Enterprise Performance 10K HDD	Constellation®	Laptop SSHD and Laptop 7mm SSHD	Momentus® Thin	Laptop Ultrathin HDD	Ultra Mobile HDD	Video 2.5 HDD
USE THIS DRIVE FOR	Enterprise storage environments requiring high-capacity SSD with data integrity and drive endurance	Data center and cloud applications that require fast performance and low power	On-the-go users who need the fastest performance and improved ruggedness	Improved storage performance tier between SSDs and high-capacity HDDs	Compute-intensive data requirements demanding the highest HDD performance density and availability	Mainstream data requiring high capacity, performance density and reliability	Online reference data demands requiring cost-effective, low-power, enterprise-class drives	The ultimate mobile computing experience, with SSD-like performance for all applications and OS environments	Slim computing devices, such as laptops and netbooks	Slim laptops and devices that need light, affordable, high-capacity storage	Robust storage for high-capacity tablets and mobile applications	Video streaming where 24x7 operation, small form factor and low power consumption are needed, 3-year limited warranty
ENCRYPTION MODELS AVAILABLE			X	X	X	X	X		X	X		
LEARN MORE	Page 18	Page 18	Page 19	Page 22	Page 22	Page 24	Page 27	Page 36	Page 36	Page 37	Page 37	Page 43

Seagate is committed to the flash-based storage market, as is evident by its line of enterprise and client SSDs, engineered to deliver ultra-fast speed and high data integrity. Seagate is focused on the continuing technology leadership that allows it to be a premier supplier of both solid state drives and hard drives.



1. One copy of the 35, 45 and 55 kDa bands and one copy of the 35 kDa band are noted to be in the expected 2:1 ratio. One copy of the 35 kDa band is noted to be in the expected 2:1 ratio. One copy of the 35 kDa band is noted to be in the expected 2:1 ratio.

1200 SSD

The Seagate 1200 SSD delivers best-in-class performance and a rich enterprise feature set for demanding data center applications.

Key Advantages

- Helps remove storage bottlenecks and close the gap between processor and data access performance
- Delivers the speed and performance consistency needed for demanding enterprise applications
- Designed to reduce data access wait times under the most complex, write-intensive workloads
- Ensures data availability for critical production systems by using redundant, failover I/O communication paths

Best-Fit Applications

- Demanding enterprise applications with complex, write-intensive and mixed workloads
- IOPS-hungry enterprise applications, such as high-performance computing, online transaction processing and heavy data analytics
- External enterprise storage solutions (SAN, NAS, DAS)



CAPACITY	MODEL	INTERFACE	NAND FLASH TYPE
800GB	ST800PM0053 ¹	SATA 12Gb/s	MLC
800GB	ST800PM0063 ²	SATA 12Gb/s	MLC
400GB	ST400PM0073 ³	SATA 12Gb/s	MLC
200GB	ST200PM0073 ³	SATA 12Gb/s	MLC

600 SSD


The ultimate performance upgrade for existing laptops, the Seagate 600 SSD is a fast, rugged, 2.5-inch, SATA 6Gb/s solid state drive.

Key Advantages

- Nearly 4x faster boot times and over 2x faster application load times than typical laptop HDDs
- Significantly reduces the amount of time end users must wait before using their devices
- Allows end users to access data faster and to take advantage of superior laptop responsiveness
- The ultimate upgrade drive for road warriors, power users, executives and gamers—work and play faster

Best-Fit Applications

- Performance upgrade for existing laptops with 2.5-inch hard drives
- Improved ruggedness upgrade for existing laptops that may be dropped while operating
- Data center caching



CAPACITY	7MM 2.5" HT MODEL	INTERFACE	NAND FLASH TYPE
480GB	ST480-MX00	SATA 6Gb/s	MLC
240GB	ST240-MX00	SATA 6Gb/s	MLC
120GB	ST120-MX00	SATA 6Gb/s	MLC

CAPACITY	5MM 2.5" HT MODEL	INTERFACE	NAND FLASH TYPE
480GB	ST480-MX01	SATA 6Gb/s	MLC
240GB	ST240-MX01	SATA 6Gb/s	MLC
120GB	ST120-MX01	SATA 6Gb/s	MLC

600 Pro SSD

A class above client SSDs, Seagate 600 Pro SSDs deliver a best-in-class combination of fast, consistent performance and low power.

Key Advantages

- Delivers the highest IOPS/watt to improve system performance and reduce power and cooling costs for data center and cloud applications
- Fast, consistent performance and low latency over the warranty period of the drive
- Helps reduce performance gaps between storage I/O and CPU operations

Best-Fit Applications

- Data center applications (fast data indexing, edge caching)
- Data streaming
- Content delivery networks
- Gaming and software delivery
- Virtualization and other cloud applications



CAPACITY	MODEL	INTERFACE	NAND FLASH TYPE
480GB	ST480PR0021	SATA 6Gb/s	MLC
400GB	ST400PR0021	SATA 6Gb/s	MLC
340GB	ST340PR0021	SATA 6Gb/s	MLC
200GB	ST200PR0021	SATA 6Gb/s	MLC
120GB	ST120PR0021	SATA 6Gb/s	MLC
100GB	ST100PR0021	SATA 6Gb/s	MLC



With more than 30 years of experience and the broadest storage product portfolio available, Seagate consistently designs, builds and supports industry-leading enterprise hard drives, solid state drives and hybrid drives. Seagate has the global presence, processes and resources to support businesses of all sizes with the highest-quality enterprise storage products.

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ENTERPRISE STORAGE

		Enterprise Turbo SSHD	Enterprise Performance HDD	Q-HEAT™	Enterprise Capacity HDD	TeraScale™ HDD Constellation CS
Legacy Name		Savvio®			Constellation	
Application		Highest SFF Performance	SFF Performance and Mainstream	LFF Performance	High Capacity and Low Power	Affordable High Capacity With Low Power
Description		World's fastest hard drive	Highest-performing, highly reliable 15K- and 10K-RPM enterprise hard drives in a 2.5-inch form factor	High-performance, legacy 15K-RPM enterprise hard drive in a 3.5-inch form factor	High-capacity, low-power, reliable 7200-RPM enterprise hard drive in both 2.5- and 3.5-inch form factors	High-capacity, eco-friendly, cost-effective storage for Web-scale data centers
Form Factor		2.5-inch	2.5-inch	3.5-inch	2.5-inch and 3.5-inch	3.5-inch
Reliability		0.44% AFR	0.44% AFR	0.55% AFR	0.62% and 1.08% AFR	800,000 MTBF
Capacity¹		300GB to 900GB	300GB to 1200GB	300GB to 600GB	250GB to 4TB	1TB to 4TB
Power (idle)		4.8W to 5.3W	4.4W to 5.3W	8.7W to 11.68W	2.52W to 7.7W	up to 4.59W
Format		50E, 40N	512N, 50E, 40N	512N	512N, 50E	512E
Interface		6Gb/s SAS	6Gb/s SAS, 4Gb/s FC	6Gb/s SAS, 4Gb/s FC	6Gb/s SAS, SATA 6Gb/s	SATA 6Gb/s
Limited Warranty²		5 years	5 years	5 years	5 years	3 years

Product	Enterprise Turbo SSHD	Enterprise Performance 15K HDD	Enterprise Performance 10K HDD	Q-HEAT™ 15K	Enterprise Capacity 3.5 HDD	Enterprise Capacity 2.5 HDD	TeraScale HDD Constellation CS
Vibration Tolerance for Multi-Drive Stabilization	X	X	X	X	X	X	X
PowerChoice™ Optimized Idle Power Settings	X	X	X		X	X	X
Self-Encrypting Drive (SED)³	X	X	X	X	X	X	
FIPS 140-2 SED Option¹	X	X	X	X	X	X	
Instant Secure Erase	X	X	X		X	X	X
Solid State Hybrid	X						
Energy-Saving Features	X	X	X		X	X	X
RoHS Compliance	X	X	X	X	X	X	X

1. One type of OS usually are 32-bit types and one type of OS usually are 64-bit types when running in the cloud.
2. All Operating System models may require OS support and/or hardware support.
3. Some PaaS models may require OS support and/or hardware support.
4. Some SaaS models may require OS support and/or hardware support.
5. Some IaaS models may require OS support and/or hardware support.

Enterprise Turbo SSHD

The Enterprise Turbo SSHD accelerates access to your most critical data with the world's fastest hard drive.

Key Advantages

- Hard drive capacities with flash-based performance
- Best economic combination of performance, endurance and capacity—best \$/IOPS enterprise HDD
- Meets critical demands for performance, scalability, flexibility and high density in a 2.5-inch form factor
- Automatically caches hot data to flash and absorbs write intensity by only promoting hot data
- Nonvolatile cache to enable faster write response time and help ensure data integrity during power loss

Best-Fit Applications

- Big data analytics
- Databases (ERP and OLTP)
- Virtual desktop infrastructure (VDI)
- Web development and Web page delivery



CAPACITY	SKNATIVE MODEL	INTERFACE	CACHE
600GB	ST600MM0004	6Gb/s SAS	128MB
800GB	ST800MM0014	6Gb/s SAS	128MB
1000GB	ST1000MM0024	6Gb/s SAS	128MB
1500GB	ST1500MM0004	6Gb/s SAS	128MB
2000GB	ST2000MM0014	6Gb/s SAS	128MB
3000GB	ST3000MM0014	6Gb/s SAS	128MB

CAPACITY	SKNATIVE MODEL	INTERFACE	CACHE
300GB	ST600MP0034	6Gb/s SAS	128MB
600GB	ST600MP0044	6Gb/s SAS	128MB
800GB	ST600MP0054	6Gb/s SAS	128MB
1500GB	ST450MP0034	6Gb/s SAS	128MB
1500GB	ST450MP0044	6Gb/s SAS	128MB
3000GB	ST300MP0034	6Gb/s SAS	128MB
3000GB	ST300MP0044	6Gb/s SAS	128MB

Enterprise Performance 15K HDD

Seagate Enterprise Performance 15K HDDs leverage a 2.5-inch form factor to deliver pronounced performance advantages and power savings over legacy 3.5-inch drives.

Key Advantages

- Stores 2x the Tier 1 data over previous generation without increasing drive count
- Enables Tier 1 applications to process transactions more quickly
- Best-in-class idle power for more efficient storage operations
- Industry's highest MTBF at 2M hours
- Self-Encrypting Drive (SED)¹ and FIPS SED² options cut IT drive retirement costs and help protect data at rest.

Best-Fit Applications

- High-performance Tier 1 enterprise servers
- Blade, rack and tower servers hosting transaction-based applications
- Power- and space-constrained data centers
- Compliance and data security initiatives



CAPACITY	SKNATIVE MODEL	INTERFACE	CACHE
450GB	ST450MP0004	6Gb/s SAS	128MB
450GB	ST450MP0014	6Gb/s SAS	128MB
300GB	ST300MP0004	6Gb/s SAS	128MB
300GB	ST300MP0014	6Gb/s SAS	128MB

CAPACITY	SKNATIVE MODEL	INTERFACE	CACHE
300GB	ST600MP0034	6Gb/s SAS	128MB
600GB	ST600MP0044	6Gb/s SAS	128MB
800GB	ST600MP0054	6Gb/s SAS	128MB
1500GB	ST450MP0034	6Gb/s SAS	128MB
1500GB	ST450MP0044	6Gb/s SAS	128MB
3000GB	ST300MP0034	6Gb/s SAS	128MB
3000GB	ST300MP0044	6Gb/s SAS	128MB

CAPACITY	SKNATIVE MODEL	INTERFACE	CACHE
500GB	ST600MP0064	6Gb/s SAS	128MB
300GB	ST600MP0074	6Gb/s SAS	128MB
600GB	ST600MP0084	6Gb/s SAS	128MB
450GB	ST450MP0064	6Gb/s SAS	128MB
450GB	ST450MP0074	6Gb/s SAS	128MB
3000GB	ST300MP0064	6Gb/s SAS	128MB
3000GB	ST300MP0074	6Gb/s SAS	128MB



¹ FIPS 140-2 approved Self-Encrypting Drive (SED) and FIPS 140-2 approved FIPS SED options are available for select models. See <http://www.seagate.com/enterprise/enterprise-storage> for more information. ² FIPS 140-2 approved FIPS SED options are available for select models. See <http://www.seagate.com/enterprise/enterprise-storage> for more information.

CAPACITY	ST/ATA MODEL	INTERFACE	SIZE
720GB	ST1200MM017	6Gb/s SAS	6.4E
120GB	ST1200MM027 ¹	6Gb/s SAS	6.4E
900GB	ST900MM002 ¹	6Gb/s SAS	6.4E
900GB	ST900MM003 ¹	6Gb/s SAS	6.4E
300GB	ST9000003S	6Gb/s SAS	6.4E
300GB	ST9900703S	6Gb/s SAS	6.4E
300GB	ST9600005S ¹	6Gb/s SAS	6.4E
900GB	ST9600005S ¹	6Gb/s SAS	6.4E
900GB	ST9900009C	4Gb/s FC	6.4E
300GB	ST600MM002 ¹	6Gb/s SAS	6.4E
300GB	ST9600003S	6Gb/s SAS	6.4E
300GB	ST9600105S ¹	6Gb/s SAS	6.4E
300GB	ST9600005S ¹	6Gb/s SAS	6.4E
300GB	ST9600039C	4Gb/s FC	6.4E
150GB	ST450MM002	6Gb/s SAS	6.4E
150GB	ST450A026S	6Gb/s SAS	6.4E
150GB	ST4500003S	6Gb/s SAS	6.4E
150GB	ST4500039S ¹	6Gb/s SAS	6.4E
150GB	ST450A049C	4Gb/s FC	6.4E
750GB	ST300MM003 ¹	6Gb/s SAS	6.4E
750GB	ST6000005S	6Gb/s SAS	6.4E
750GB	ST9000008S	6Gb/s SAS	6.4E
750GB	ST9300A049C ¹	6Gb/s SAS	6.4E
750GB	ST9600009C	4Gb/s FC	6.4E

CAPACITY	SERIAL NO.	INTERFACE	COLOR
100GB	5733000575S	8QW SAS	19MB
100GB	5733000975S	8QW SAS	19MB
100GB	5733000575S ¹	8QW SAS	19MB
100GB	5733000575C	4QW FC	19MB
100GB	5734505975S	8QW SAS	19MB
100GB	573300575S ¹	8QW SAS	19MB
100GB	573450575S ¹	8QW SAS	19MB
100GB	5734505975C	4QW FC	19MB
100GB	573300575S	8QW SAS	19MB
100GB	5733005575S	8QW SAS	19MB
100GB	573300575C	4QW FC	19MB

Enterprise Capacity 3.5 HDD

The Seagate Enterprise Capacity 3.5 HDDs help data centers meet the demanding growth of unstructured data.



Key Advantages

- Highest-capacity enterprise drive for maximum density server and storage solutions
- SAS and SATA interfaces with 24x7 reliability
- Predictable 7200-RPM performance even in the most rugged multi-drive environments
- Improved power and cooling efficiencies with low power consumption and on-demand PowerChoice™ technology
- Protect your data and ease data disposal costs and management with the Self-Encrypting Drive (SED) and FIPS 140-2 certified SED^{1,2}

Best-Fit Applications

- High-capacity RAID storage
- Mainstream enterprise external storage (SAN, NAS, DAS)
- Cloud bulk data storage
- Enterprise backup and restore—D2D, virtual tape
- Centralized surveillance

CAPACITY	S/N & MTBF MODEL	INTERFACE	CACHE
4TB	ST4000NM0033	SATA 6Gb/s	128MB
6TB	ST6000NM0057	SATA 6Gb/s	128MB
8TB	ST8000NM0072 ¹	SATA 6Gb/s	128MB
10TB	ST10000NM0083	6Gb/s SAS	128MB
12TB	ST12000NM0043 ¹	6Gb/s SAS	128MB
14TB	ST14000NM0063 ¹	6Gb/s SAS	128MB
16TB	ST16000NM0033	SATA 6Gb/s	128MB
18TB	ST18000NM0057	SATA 6Gb/s	128MB
20TB	ST20000NM0023	6Gb/s SAS	128MB
24TB	ST24000NM0043	6Gb/s SAS	128MB
28TB	ST28000NM0063 ¹	6Gb/s SAS	128MB
30TB	ST30000NM0033	SATA 6Gb/s	128MB
36TB	ST36000NM0057	SATA 6Gb/s	128MB
40TB	ST40000NM0023	6Gb/s SAS	128MB
48TB	ST48000NM0043	6Gb/s SAS	128MB
56TB	ST56000NM0063 ¹	6Gb/s SAS	128MB
60TB	ST60000NM0033	SATA 6Gb/s	128MB
72TB	ST72000NM0057	SATA 6Gb/s	128MB
80TB	ST80000NM0023	6Gb/s SAS	128MB
96TB	ST96000NM0043	6Gb/s SAS	128MB
112TB	ST112000NM0063 ¹	6Gb/s SAS	128MB
120TB	ST120000NM0033	SATA 6Gb/s	128MB
144TB	ST144000NM0057	SATA 6Gb/s	128MB
160TB	ST160000NM0023	6Gb/s SAS	128MB
192TB	ST192000NM0043	6Gb/s SAS	128MB
224TB	ST224000NM0063 ¹	6Gb/s SAS	128MB

Constellation®

The Seagate Constellation drive is the only 2.5-inch enterprise-class hard drive delivering both 1TB capacities and enterprise reliability.



Key Advantages

- Maximizes data center footprint
- Energy-efficient storage at under 3.9W (idle)
- Highest nearline reliability with an MTBF of 1.4M hours
- Self-Encrypting Drive (SED)¹ and FIPS 140-2 certified SED¹ cut IT drive retirement costs and protect data
- FIPS options meet government encryption compliance standards.

Best-Fit Applications

- Storage-hungry business applications
- Storage area networks and network attached storage
- Maximum-capacity servers and blade servers
- Rich media content storage
- Enterprise backup and restore—D2D, virtual tape
- Cloud computing

CAPACITY	S/N & MTBF MODEL	INTERFACE	CACHE
1TB	ST91000640NS	SATA 6Gb/s	64MB
1TB	ST91000641NS ¹	SATA 6Gb/s	64MB
1TB	ST91000642NS ¹	SATA 6Gb/s	64MB
1TB	ST91000640SS	6Gb/s SAS	64MB
1TB	ST91000641SS ¹	6Gb/s SAS	64MB
1TB	ST91000642SS ¹	6Gb/s SAS	64MB
500GB	ST9500620NS	SATA 6Gb/s	64MB
500GB	ST9500621NS ¹	SATA 6Gb/s	64MB
500GB	ST9500622NS ¹	SATA 6Gb/s	64MB
500GB	ST9500620SS	6Gb/s SAS	64MB
500GB	ST9500621SS ¹	6Gb/s SAS	64MB
500GB	ST9500622SS ¹	6Gb/s SAS	64MB
250GB	ST9250610NS	SATA 6Gb/s	64MB
250GB	ST9250611NS ¹	SATA 6Gb/s	64MB
250GB	ST9250612NS ¹	SATA 6Gb/s	64MB

Terascale™ HDD Constellation® CS


The Seagate Terascale HDD and Constellation CS are designed for large Web-scale data centers where low-cost, low-power and high-capacity storage is critical.

Key Advantages

- Affordable storage for 24×7 multi-drive replicated environments
- High vibration tolerance for reliable enterprise-class performance
- Low power and cooling costs with the lowest 3.5-inch enterprise drive operating power
- Advanced format logical block management for industry-leading data integrity

Best-Fit Applications

- Web-scale computing
- Cloud storage servers and arrays
- Cloud backup storage
- Direct-attached external storage (DAS)
- Network-attached storage (NAS)



CAPACITY	SKU	MODEL	INTERFACE	CACHE
4TB	ST4000NC000	7	SATA 6Gb/s	64MB
4TB	ST4000NC001	7	SATA 6Gb/s	64MB
3TB	ST3000NC002	7	SATA 6Gb/s	64MB
3TB	ST3000NC000	7	SATA 6Gb/s	64MB
2TB	ST2000NC001	7	SATA 6Gb/s	64MB
2TB	ST2000NC000	7	SATA 6Gb/s	64MB
1TB	ST1000NC001	7	SATA 6Gb/s	64MB
1TB	ST1000NC000	7	SATA 6Gb/s	64MB



Desktop Storage Solutions

Seagate has a distinguished history in consistently delivering innovative technologies, super-sized capacities, low power and blazing-fast performance. Seagate desktop drives offer excellent performance at all levels.

DESKTOP STORAGE



	DESKTOP SSHD	DESKTOP SHDD INTERNAL KIT	DESKTOP HDD	DESKTOP 3.5 INCH INTERNAL KIT
Legacy Name			BarraCuda®	BarraCuda
Application	Performance	Performance	Mainstream	Mainstream
Description	Solid state hybrid drive delivers SSD-like performance without sacrificing capacity	The easy way to upgrade or add storage capacity to desktop computers to get solid state speed for fast, responsive system performance	Tuned performance for low-power, mainstream and high-performance desktop computing	The fast, powerful and easy way to upgrade or add storage capacity to desktop computers
Capacity ¹	1TB to 4TB	1TB to 4TB	250GB to 4TB	500GB to 4TB
Interface	SATA 6Gb/s	SATA 6Gb/s	SATA 6Gb/s	SATA 3Gb/s, SATA 6Gb/s
Form Factor	3.5 inch	3.5 inch	3.5 inch	3.5 inch
Reliability	<1% AFR	<1% AFR	<1% AFR	<1% AFR
Cache	64MB	64MB	16MB to 64M	16MB to 64M
Power (idle)	<3.3W to <3.9W	<3.3W to <3.9W	4.0W to 5.8W	
Product	Desktop SSHD	Desktop SHDD Internal Kit	Desktop HDD	Desktop 3.5 inch Internal Kit
OptiCache™ Technology			X	X
Solid State Hybrid	X	X		
Mounting Hardware and Cables		X		X
Compatible with Windows 8 ²	X	X	X	X
Energy-Saving Features	X	X	X	X
RoHS Compliance ³	X	X	X	X

¹ One 3.5-inch or 2.5-inch drive (250GB to 4TB) and one 3.5-inch or 2.5-inch drive (250GB to 4TB) capacity.
² For a complete list of Seagate products that are compatible with Windows 8, visit <http://www.seagate.com/compatibility/windows8>.

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Desktop SSHD

Seagate Desktop SSHD (solid state hybrid drive) delivers SSD-like performance and massive capacities at an affordable price.

Key Advantages

- First SSHD in a 3.5-inch form factor
- SATA 6Gb/s with NCQ for interface speed
- Up to 3x faster than a traditional HDD²
- All-in-one design for ease of installation
- Installs and operates like a standard hard drive
- Massive 1TB or 2TB capacities combined with SSD-like performance²

Best-Fit Applications

- Desktop PCs
- Workstations
- High-performance direct-attached storage (DAS) devices



CAPACITY	MODEL	INTERFACE	CACHE
4TB	ST2000D001	SATA 6Gb/s	64MB
2TB	ST2000D001	SATA 6Gb/s	64MB
1TB	ST1000D001	SATA 6Gb/s	64MB

Desktop 3.5-Inch Internal Kit

Seagate 3.5-inch internal drives are the fast, powerful, and easy way to upgrade or add storage capacity to desktop computers.

Key Advantages

- Quiet, ultra-high performance
- DiscWizard™ software makes installation a snap
- Built-in self-monitoring technology helps ensure maximum reliability
- Desktop solid state hybrid model offers SSD-like performance with the capacity of a hard drive

Best-Fit Applications

- Gaming PCs
- Workstations
- High-end PCs
- Desktop RAID
- Mainstream/office PCs



CAPACITY	KIT NUMBER	INTERFACE	CACHE
4TB	STBD4000400	SATA 6Gb/s	64MB
3TB	STBD3000100	SATA 6Gb/s	64MB
2TB	STBD2000101	SATA 6Gb/s	64MB
1TB	ST310009N1A1AS-RK	SATA 6Gb/s	64MB
500GB	ST3500641AS-RK	SATA 3Gb/s	64MB

PACKAGE DIMENSIONS: 7.38-in L x 5.88-in W x 2.88-in D (187mm x 149mm x 73mm)

CAPACITY	KIT NUMBER	INTERFACE	MULTIPLASH
2TB	STCL2000400	SATA 6Gb/s	8GB

PACKAGE DIMENSIONS: 5.88-in L x 7.38-in W x 2.88-in D (149.35mm x 187.45mm x 73.15mm)

Desktop HDD

Seagate Desktop HDDs give you the Power of One with 1TB-per-disk technology and one drive platform for every capacity and application.

Key Advantages

- Up to 4TB capacity
- AcuTrac™ and OptiCache™ technologies deliver dependable overall performance
- Free Seagate DiscWizard™ software

Best-Fit Applications

- Desktop or all-in-one PCs and home servers
- PC-based gaming systems
- Direct-attached external storage devices (DAS)



CAPACITY	MODEL	INTERFACE	CACHE
4TB	ST4000DM000	SATA 6Gb/s NCQ	64MB
3TB	ST3000DM001	SATA 6Gb/s NCQ	64MB
2TB	ST2000DM001	SATA 6Gb/s NCQ	64MB
1TB	ST1000DM003	SATA 6Gb/s NCQ	64MB
300GB	ST500DM002	SATA 6Gb/s NCQ	16MB
320GB	ST320DM000	SATA 6Gb/s NCQ	16MB
250GB	ST250DM000	SATA 6Gb/s NCQ	16MB



¹ Up to 3x faster than HDD, based on disk sequential performance of 1TB model, one million random access rate (IOPS) and latency. ² Based on average read/write speed of 100MB/s and 100MB/s for random access rate (IOPS) and latency. ³ IOPS is subject to system configuration.

Seagate laptop and tablet drives address every mobile market need, delivering superior performance, reliability and value. Feature-rich with innovative options, the Seagate mobile lineup also includes self-encryption and FIPS 140-2 validated models.

Seagate laptop and tablet drives address every mobile market need, delivering superior performance, reliability and value. Feature-rich with innovative options, the Seagate mobile lineup also includes self-encryption and FIPS 140-2 validated models.

[illegible]

Laptop SSHD and Laptop Thin SSHD

The Seagate Laptop SSHD (1TB) and Laptop Thin SSHD (500GB) enable laptop PC users to enjoy solid state performance without sacrificing capacity.



Key Advantages

- Boots and performs like an SSD¹
- Up to 4x faster than a traditional HDD²
- SATA 6Gb/s with NCQ for interface speed
- All-in-one design for simplicity and ease of installation
- Works in any laptop or PC, any OS and any application
- Backed by a 3-year limited warranty

Best-Fit Applications

- Laptops and mobile workstations
- Desktop and tower workstations
- High-performance laptop and desktop gaming systems
- Small form factor all-in-one PCs

CAPACITY	MODEL	INTERFACE	CACHE
1TB	ST1000LM014	SATA 6Gb/s	64MB
500GB	ST500LM000	SATA 3Gb/s	64MB

Laptop Ultrathin HDD

The Seagate Laptop Ultrathin HDD is one of the thinnest and lightest laptop hard drives—5mm, 3.3 oz. and thinner than a pencil.



Key Advantages

- Affordable, high-capacity storage gives system builder options when integrating low profile storage into slim laptop and ultrabook solutions
- Compatible with every portable PC with a standard SATA 6Gb/s interface
- Get industry-leading cost-per-GB and cost-per-millimeter
- Seagate Secure³ Self-Encrypting Drive options⁴

Best-Fit Applications

- Slim laptops or ultrabooks
- Extending high-capacity, affordable storage into other applications and slim devices
- Backup storage

CAPACITY	MODEL	INTERFACE	CACHE
320GB	ST500LT002	SATA 6Gb/s	16MB
500GB	ST500LT003	SATA 6Gb/s	16MB
500GB	ST500LT000	SATA 6Gb/s	16MB

Momentus[®] Thin

The 7mm, 2.5-inch drive enables slim computing for all types of mobile computing, from laptops to netbooks to smaller desktop PCs.



Key Advantages

- 7mm z-height form factor enables thin chassis design for all segments of laptop computing
- Seagate SmartAlign[™] technology provides a transition to 4K sectors without the need for software utilities.
- Self-Encrypting Drive⁵ options mitigate data breaches, comply with data protection regulations and preserve brand recognition.
- Self-Encrypting Drive options with FIPS 140-2 certification⁶ are government-approved for the U.S. and Canadian governments.

Best-Fit Applications

- Thin entry-level laptop PCs
- Thin high-end netbooks
- Thin ultraportables

CAPACITY	MODEL	INTERFACE	CACHE
320GB	ST500LT025 ⁷	SATA 6Gb/s	16MB
500GB	ST500LT019 ⁸	SATA 6Gb/s	16MB
500GB	ST500LT012	SATA 6Gb/s	16MB
320GB	ST320LT012	SATA 6Gb/s	16MB
320GB	ST320LT012	SATA 6Gb/s	16MB

Ultra Mobile HDD

Just 5mm thin and supported by a stainless steel design, the Seagate Ultra Mobile HDD is ready for mobility.



Key Advantages

- 500GB brings 7x more space to tablet applications at a fraction of the cost.
- Zero-gravity sensors provide extra drop protection.
- Improved shock and tolerance for gyroscopic motion supports even the intense maneuvers of gamers.
- Just 3.3 oz.—about the weight of a lightbulb
- Couple with the Seagate Mobile Enablement Kit's Dynamic Data⁹ Driver for robust and responsive storage with no compromise to system battery life.

Best-Fit Applications

- Tablets
- Convertible and detachable storage
- Ultra-mobile, ultra-portable storage expansion apps

CAPACITY	MODEL	INTERFACE	CACHE
500GB	ST500LT025	SATA 6Gb/s	16MB

MOBILE STORAGE

Laptop 2.5-Inch Internal Kit

Seagate 2.5-inch internal drives deliver vast amounts of storage for adding capacity or upgrading drives in laptop computers.

Key Advantages

- Built for mobility
- Preserves battery life
- Large data cache
- Outstanding performance
- Laptop solid state hybrid model offers SSD-like performance with the capacity of a hard drive.

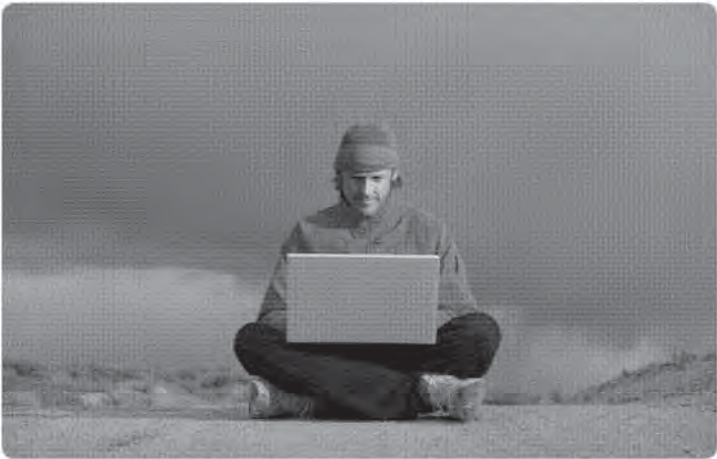
Best-Fit Applications

- Replacement laptop drives
- Laptop storage upgrades
- High-end laptops and workstations



CAPACITY	KIT NUMBER	INTERFACE	CACHE
1TB	STED1000100	SATA 3Gb/s	8MB
500GB	ST9050030A1AS-RK	SATA 3Gb/s	16MB
500GB	ST9050030H1A1AS-RK	SATA 3Gb/s	8MB
250GB	ST90250N1A1AS-RK	SATA 3Gb/s	8MB
PACKAGE DIMENSIONS	6.25-in L x 4.75-in W x 2.25-in D (159mm x 121mm x 57mm)		

LAPTOP-SHD MODEL			
CAPACITY	KIT NUMBER	INTERFACE	MECH/FLASH
1TB	STED1000400	SATA 6Gb/s	8GB
PACKAGE DIMENSIONS	6.25-in L x 4.75-in W x 2.25-in D (159mm x 121mm x 57mm)		



¹ One gigabyte (1 GB) equals one billion bytes and one terabyte (1 TB) equals one trillion bytes, where 1 terabyte is 1,000 gigabytes. 2015 model numbers shown.

Specialty Storage Solutions

Storage solutions for NAS, DVRs and surveillance systems

Seagate has the expertise to build drives optimized for specialty environments, like Network Attached Storage (NAS), CE and video storage. Our global presence, business partnerships, technology leadership and industry understanding enable Seagate to deliver industry-leading products.

SPECIALTY STORAGE



	NAS HDD	SV35 SERIES™	VIDEO 3.5 HDD	VIDEO 2.5 HDD
Legacy Name			Pipeline™ HD	Pipeline HD Mini
Application	Small NAS	Video Surveillance	Mainstream CE-DVR	Small form factor CE-DVR
Description	Best-performing, highest-capacity storage for 1- to 5-bay NAS systems	Optimized performance and improved reliability for video surveillance applications	Cool, quiet, low-power performance—perfect for high-definition consumer DVR applications	Cool, quiet, low power—perfect for small form factor and power-sensitive designs
Capacity ¹	2TB to 4TB	1TB to 3TB	250GB to 4TB	250GB to 500GB
Interface	SATA 6Gb/s	SATA 6Gb/s	SATA 3Gb/s, SATA 6Gb/s	SATA 3Gb/s
Form Factor	3.5-inch	3.5-inch	3.5-inch	2.5-inch
Simultaneous HD Streams Supported	—	—	up to 16	up to 12
Reliability	1M hours MTBF	<1% AFR	0.55% AFR	0.55% AFR
Cache	64MB	64MB	8MB to 64MB	16MB
Power (Idle)	3.0W to 3.95W	3.36W to 5.4W (Idle2)	2.9W to 5.0W	0.66W
Product	NAS HDD	SV35 Series	Video 3.5 HDD	Video 2.5 HDD
Cool Operation		x	x	x
24x7 Operation Capable	x	x	x	x
Extremely Low Vibration	x			
NASWorks™ Technology	x			
Energy-Saving Features	x		x	x
RoHS Compliance	x	x	x	x

¹ One gigabyte is 1,024 megabytes and one terabyte is 1,024 gigabytes. Seagate uses binary notation when referring to drive capacity.

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NAS HDD

The Seagate NAS HDD fine-tunes the needs of 1- to 5-bay NAS systems to provide industry-leading performance and highest-capacity storage.

Key Advantages

- NASWorks™ technology supports custom error recovery controls, power management and vibration tolerance.
- NAS error recovery controls help to ensure drives are not dropped from the NAS and sent into a RAID rebuild.
- Improved vibration tolerance and emission in multi-drive systems with dual-plane balance.
- Advanced power management supports multiple power profiles for low-power, 24x7 performance.

Best-Fit Applications

- Home servers or desktop NAS solutions
- Small-business file sharing
- Backup servers



CAPACITY	MODEL	INTERFACE	CACHE
4TB	ST4000NA000	SATA 6Gb/s	64MB
6TB	ST6000NA000	SATA 6Gb/s	64MB
8TB	ST8000NA000	SATA 6Gb/s	64MB

Video 3.5 HDD

Seagate Video 3.5 HDDs deliver unprecedented levels of acoustic, power and vibration performance with room for hundreds of your favorite movies.

Key Advantages

- Quiet drive operation to enhance customer viewing and listening experiences
- 75°C, 24-hour operation capable
- Operational power consumption as low as 3.4W
- 2.0A spin-up current limited

Best-Fit Applications

- Consumer digital video recorders
- Media servers and centers
- Home theater PCs and servers
- Cable, satellite and IPTV set-top boxes



CAPACITY	MODEL	INTERFACE	CACHE
4TB	ST4000VX000	SATA 6Gb/s	64MB
6TB	ST6000VX000	SATA 6Gb/s	64MB
8TB	ST8000VX000	SATA 6Gb/s	64MB
10TB	ST10000VX000	SATA 6Gb/s	64MB
12TB	ST12000VX000	SATA 6Gb/s	64MB
14TB	ST14000VX000	SATA 6Gb/s	64MB
16TB	ST16000VX000	SATA 6Gb/s	64MB
18TB	ST18000VX000	SATA 6Gb/s	64MB
20TB	ST20000VX000	SATA 6Gb/s	64MB
22TB	ST22000VX000	SATA 6Gb/s	64MB
24TB	ST24000VX000	SATA 6Gb/s	64MB
26TB	ST26000VX000	SATA 6Gb/s	64MB
28TB	ST28000VX000	SATA 6Gb/s	64MB
30TB	ST30000VX000	SATA 6Gb/s	64MB
32TB	ST32000VX000	SATA 6Gb/s	64MB
34TB	ST34000VX000	SATA 6Gb/s	64MB
36TB	ST36000VX000	SATA 6Gb/s	64MB
38TB	ST38000VX000	SATA 6Gb/s	64MB
40TB	ST40000VX000	SATA 6Gb/s	64MB
42TB	ST42000VX000	SATA 6Gb/s	64MB
44TB	ST44000VX000	SATA 6Gb/s	64MB
46TB	ST46000VX000	SATA 6Gb/s	64MB
48TB	ST48000VX000	SATA 6Gb/s	64MB
50TB	ST50000VX000	SATA 6Gb/s	64MB
52TB	ST52000VX000	SATA 6Gb/s	64MB
54TB	ST54000VX000	SATA 6Gb/s	64MB
56TB	ST56000VX000	SATA 6Gb/s	64MB
58TB	ST58000VX000	SATA 6Gb/s	64MB
60TB	ST60000VX000	SATA 6Gb/s	64MB
62TB	ST62000VX000	SATA 6Gb/s	64MB
64TB	ST64000VX000	SATA 6Gb/s	64MB
66TB	ST66000VX000	SATA 6Gb/s	64MB
68TB	ST68000VX000	SATA 6Gb/s	64MB
70TB	ST70000VX000	SATA 6Gb/s	64MB
72TB	ST72000VX000	SATA 6Gb/s	64MB
74TB	ST74000VX000	SATA 6Gb/s	64MB
76TB	ST76000VX000	SATA 6Gb/s	64MB
78TB	ST78000VX000	SATA 6Gb/s	64MB
80TB	ST80000VX000	SATA 6Gb/s	64MB
82TB	ST82000VX000	SATA 6Gb/s	64MB
84TB	ST84000VX000	SATA 6Gb/s	64MB
86TB	ST86000VX000	SATA 6Gb/s	64MB
88TB	ST88000VX000	SATA 6Gb/s	64MB
90TB	ST90000VX000	SATA 6Gb/s	64MB
92TB	ST92000VX000	SATA 6Gb/s	64MB
94TB	ST94000VX000	SATA 6Gb/s	64MB
96TB	ST96000VX000	SATA 6Gb/s	64MB
98TB	ST98000VX000	SATA 6Gb/s	64MB
100TB	ST100000VX000	SATA 6Gb/s	64MB

SV35 Series™

The Seagate SV35 series drives optimize performance, save power and improve reliability for video surveillance applications.

Key Advantages

- Higher areal density for cost-effective DVR applications
- Performance-tuned for seamless video applications
- Enterprise-class reliability for 24x7 video surveillance applications
- Built-in error recovery for non-stop streaming

Best-Fit Applications

- Video surveillance digital video recorder
- Video surveillance network digital video recorder
- Direct-attached JBOD video surveillance storage
- Network-attached JBOD video storage



CAPACITY	MODEL	INTERFACE	CACHE
2TB	ST2000VX000	SATA 6Gb/s	64MB
3TB	ST3000VX000	SATA 6Gb/s	64MB
4TB	ST4000VX000	SATA 6Gb/s	64MB

Video 2.5 HDD

Seagate Video 2.5 HDDs let you stream, record and play back your video content with unparalleled reliability and performance.

Key Advantages

- Virtually silent streaming performance as low as 19dB
- Built for 24x7 operation and low power consumption
- Small, 2.5-inch form factor allows system cost reduction and operational power savings
- Fanless design allows flexibility in a sleek system design
- 0.55% AFR supports longevity in demanding consumer electronic environments

Best-Fit Applications

- DVR and media center applications
- Home theater PCs
- Karaoke and audio jukeboxes
- Cable, satellite and IPTV set-top boxes
- In-camera or surveillance systems



CAPACITY	MODEL	INTERFACE	CACHE
100GB	ST1000VX000	SATA 3Gb/s	16MB
200GB	ST2000VX000	SATA 3Gb/s	16MB
300GB	ST3000VX000	SATA 3Gb/s	16MB
400GB	ST4000VX000	SATA 3Gb/s	16MB
500GB	ST5000VX000	SATA 3Gb/s	16MB
600GB	ST6000VX000	SATA 3Gb/s	16MB
700GB	ST7000VX000	SATA 3Gb/s	16MB
800GB	ST8000VX000	SATA 3Gb/s	16MB
900GB	ST9000VX000	SATA 3Gb/s	16MB
1TB	ST1000VX000	SATA 3Gb/s	16MB
1.5TB	ST1500VX000	SATA 3Gb/s	16MB
2TB	ST2000VX000	SATA 3Gb/s	16MB
3TB	ST3000VX000	SATA 3Gb/s	16MB
4TB	ST4000VX000	SATA 3Gb/s	16MB
5TB	ST5000VX000	SATA 3Gb/s	16MB
6TB	ST6000VX000	SATA 3Gb/s	16MB
7TB	ST7000VX000	SATA 3Gb/s	16MB
8TB	ST8000VX000	SATA 3Gb/s	16MB
9TB	ST9000VX000	SATA 3Gb/s	16MB
10TB	ST10000VX000	SATA 3Gb/s	16MB
12TB	ST12000VX000	SATA 3Gb/s	16MB
14TB	ST14000VX000	SATA 3Gb/s	16MB
16TB	ST16000VX000	SATA 3Gb/s	16MB
18TB	ST18000VX000	SATA 3Gb/s	16MB
20TB	ST20000VX000	SATA 3Gb/s	16MB
22TB	ST22000VX000	SATA 3Gb/s	16MB
24TB	ST24000VX000	SATA 3Gb/s	16MB
26TB	ST26000VX000	SATA 3Gb/s	16MB
28TB	ST28000VX000	SATA 3Gb/s	16MB
30TB	ST30000VX000	SATA 3Gb/s	16MB
32TB	ST32000VX000	SATA 3Gb/s	16MB
34TB	ST34000VX000	SATA 3Gb/s	16MB
36TB	ST36000VX000	SATA 3Gb/s	16MB
38TB	ST38000VX000	SATA 3Gb/s	16MB
40TB	ST40000VX000	SATA 3Gb/s	16MB
42TB	ST42000VX000	SATA 3Gb/s	16MB
44TB	ST44000VX000	SATA 3Gb/s	16MB
46TB	ST46000VX000	SATA 3Gb/s	16MB
48TB	ST48000VX000	SATA 3Gb/s	16MB
50TB	ST50000VX000	SATA 3Gb/s	16MB
52TB	ST52000VX000	SATA 3Gb/s	16MB
54TB	ST54000VX000	SATA 3Gb/s	16MB
56TB	ST56000VX000	SATA 3Gb/s	16MB
58TB	ST58000VX000	SATA 3Gb/s	16MB
60TB	ST60000VX000	SATA 3Gb/s	16MB
62TB	ST62000VX000	SATA 3Gb/s	16MB
64TB	ST64000VX000	SATA 3Gb/s	16MB
66TB	ST66000VX000	SATA 3Gb/s	16MB
68TB	ST68000VX000	SATA 3Gb/s	16MB
70TB	ST70000VX000	SATA 3Gb/s	16MB
72TB	ST72000VX000	SATA 3Gb/s	16MB
74TB	ST74000VX000	SATA 3Gb/s	16MB
76TB	ST76000VX000	SATA 3Gb/s	16MB
78TB	ST78000VX000	SATA 3Gb/s	16MB
80TB	ST80000VX000	SATA 3Gb/s	16MB
82TB	ST82000VX000	SATA 3Gb/s	16MB
84TB	ST84000VX000	SATA 3Gb/s	16MB
86TB	ST86000VX000	SATA 3Gb/s	16MB
88TB	ST88000VX000	SATA 3Gb/s	16MB
90TB	ST90000VX000	SATA 3Gb/s	16MB
92TB	ST92000VX000	SATA 3Gb/s	16MB
94TB	ST94000VX000	SATA 3Gb/s	16MB
96TB	ST96000VX000	SATA 3Gb/s	16MB
98TB	ST98000VX000	SATA 3Gb/s	16MB
100TB	ST100000VX000	SATA 3Gb/s	16MB

Partner Resources and Benefits

The Seagate Partner Program (SPP) provides access to unique resources and benefits to help channel partners secure new opportunities and grow revenue and profitability.

As a registered SPP member, you enjoy the following exclusive features:

- Password-protected portal
- E-newsletter and regular news updates
- New product evaluation unit program
- Training and sales tools
- Priority support

Start reaping the rewards of SPP membership—register today at www.seagate.com/www/partners

- Complete the online form.
- Click through and accept our standard agreement.



Service and Support

For information regarding products and services, visit www.seagate.com/about/contact-us/technical-support

Available services include:

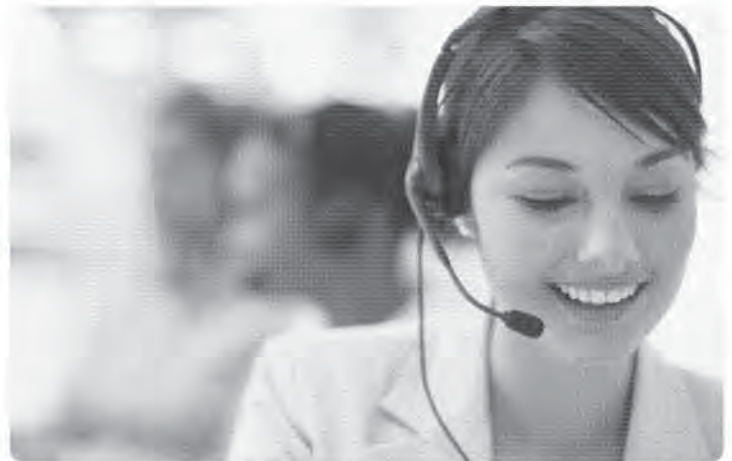
- Presales and Technical Support
- Global Support Services telephone numbers and business hours
- Authorized Seagate Service Centers

For information regarding Warranty Support, visit www.seagate.com/support/warranty-and-returns

For information regarding Data Recovery Services, visit www.seagate.com/services-software/

For Seagate OEM and Distribution partner portal, visit www.seagate.com/www/partners

For Seagate reseller portal, visit www.seagate.com/www/partners





Seagate Technology LLC
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Cupertino, California 95014
408-658-1000

EXHIBIT 21

Subject: Fwd: Agenda for QIR Executive Reviews, Oct 30-31
From: Andrei Khurshudov <andrei.khurshudov@seagate.com>
To: Dmitriy Y Vassilyev <dmitriy.y.vassilyev@seagate.com>
FAITH for Internal FA (LO) - 10Oct12.xlsx

data for the failure pareto sample size reduction study...

Regards,

Andrei Khurshudov, Ph.D
Sr. Director

Cloud Storage Quality Engineering
Seagate Technology

T 720.684.2656
F 720.684.1128
C 303.652.7577

andrei.khurshudov@seagate.com

389 Disc Drive • Longmont, CO
80503 • USA

----- Forwarded message -----

From: **Chris G Labbe** <chris.g.labbe@seagate.com>
Date: Sun, Oct 21, 2012 at 9:13 PM
Subject: Re: Agenda for QIR Executive Reviews, Oct 30-31
To: Andrei Khurshudov <andrei.khurshudov@seagate.com>

Here's our daily report on the 90 day inventory of failures by source.

Mostly, the operation of concern is CST2, which indicates the QA version of GIO, usually run as LODT.

In the recent history, Grenada is the highest volume by far. But Grenada is not very stable right now. It could be a good study since it would represent the extreme ... could we still catch the existing problems even with nearly constant shifts in performance.

Otherwise, Pharaoh is the other candidate. More mature and stable. If sampling doesn't reveal the same answer here, then it might not on any other program :)

Chris Labbe
Sr. Director
Analysis & Solutions Engineering
Seagate Technologies

"Always A Solution"

Thai cell (66) 086-892-2810
Thai office (66) 04-470-3933
US vmail 1 (720) 864-1012

On Tue, Oct 16, 2012 at 5:34 AM, Andrei Khurshudov <andrei.khurshudov@seagate.com> wrote:

Hi Chris,
it was good talking to you at the Tech Review (and in the Airport).
We will now start working on the project that we have discussed. When possible, we would like to receive the following actual data for whatever product you chose (or, for several products):

- List of ODT failures that went into FA (I presume, all ODT failures) in the order of failure events
- for each failure, please provide the identified failure mode

Our goal will be - for now - to check if it is possible to do FA on half of these drives WITHOUT LOSING INFO ABOUT FAILURE PARETO, EXCURSIONS, etc.
In other words, could we reduce the ODT FA sampling rate by 2x without any loss in fidelity of data and conclusions?

I will keep you updated on our progress and please correct me if my goal definition is not too accurate. thanks!

Regards,

Andrei Khurshudov, Ph.D
Sr. Director

Cloud Storage Quality Engineering
Seagate Technology

T 720.684.2656
F 720.684.1128
C 303.652.7577

andrei.khurshudov@seagate.com

389 Disc Drive • Longmont, CO
80503 • USA

On Mon, Oct 15, 2012 at 4:40 PM, Chris G Labbe <chris.g.labbe@seagate.com> wrote:

Todd,

no timeline attached.

Chris Labbe
Sr. Director
Analysis & Solutions Engineering
Seagate Technologies

"Always A Solution"

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Thai office (66) 04-470-3933
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On Mon, Oct 15, 2012 at 1:47 PM, Todd A Stute <todd.a.stute@seagate.com> wrote:

I've set a tentative agenda for the QIR Project Executive Reviews, scheduled for Oct 30/31.

In preparation for those reviews, please complete the following:

1. By Oct 19th, let me know whether you accept the date and time slot I've assigned your project. Let me know who will be presenting the project review to the executives (speaker).
2. By Oct 26th, provide me with a short powerpoint presentation that will be used in the review. Since we have 12+ projects to review in under than 120 minutes of valuable executive time, we have to keep them all short and concise (6-8 minutes max!!!). To that end, please adhere to the following:
 1. Limit your presentation to 2-3 slides in addition to your project charter slide(s) you'll find in the attached presentation. I can include more slides in the backup but we need to keep the talking slides to 2-3 per project review.
 2. On these slides, emphasize your project status (what you've accomplished or are planning to do shortly) and key objectives(what

you plan to accomplish through this project). Also, highlight anywhere that you'd like executive feedback on (issues, challenges, roadblocks). Finally, provide a general timeline for project completion.

3. I've included a template for your convenience.

Any questions or concerns, let me know ASAP.

--
Todd A. Stute
Seagate Corporate Quality
(952) 402-5981

EXHIBIT 25

From: Wanda W Pearson <wanda.w.pearson@seagate.com>
Subject: Fwd: Most Reliable HDDs After Analyzing 25,000 Units - Backblaze
To: Sai S Varanasi <sai.s.varanasi@seagate.com>, Ronald E Lane <ronald.e.lane@seagate.com>
Cc: Suzette Simonich <Suzette.L.Simonich@seagate.com>, Joel Hagberg <joel.hagberg@seagate.com>, John D Grieci <john.d.grieci@seagate.com>

I was talking to Rob Volpe this afternoon and he mentioned this article to me. The fail rates for the Seagate drives are astounding. And the article is pretty damaging. Are you aware of any reason the fail rates would be this bad? And do we have any returns from Backblaze?

wp

Most Reliable HDDs After Analyzing 25,000 Units – Backblaze

1/ HGST, 2/ WD, 3/ Seagate

This is a Press Release edited by StorageNewsletter.com on 2014.01.31

[Jump right to our comments](#)



This [report](#) has been published on te the blog of Backblaze, author being Brian Beach, principal engineer, [Backblaze, Inc.](#)



What HDD Should I Buy?


My last two blog posts were about [expected drive lifetimes](#) and [drive reliability](#). These posts were an outgrowth of the careful work that we've done at Backblaze to find the most cost-effective disk drives. Running a truly unlimited online backup service for only \$5 per month means our cloud storage needs to be very efficient and we need to quickly figure out which drives work.

Because Backblaze has a history of openness, many readers expected more details in my previous posts. They asked what drive models work best and which last the longest. Given our experience with over 25,000 drives, they asked which ones are good enough that we would buy them again. In this post, I'll answer those questions.

Drive Population

At the end of 2013, we had 27,134 consumer-grade drives spinning in [Backblaze Storage Pods](#). The breakdown by brand looks like this:

HDDs by Manufacturer Used by Backblaze



Seagate	12,765	39,576	1.4
Hitachi	12,956	36,078	2.0
Western Digital	2,838	2,581	2.5
Toshiba	58	174	0.7
Samsung	18	18	3.7

As you can see, they are mostly Seagate and Hitachi drives, with a good number of Western Digital thrown in. We don't have enough Toshiba or Samsung drives for good statistical results.

Why do we have the drives we have? Basically, we buy the least expensive drives that will work. When a new drive comes on the market that looks like it would work, and the price is good, we test a pod full and see how they perform. The new drives go through initial setup tests, a stress test, and then a couple weeks in production. (A couple of weeks is enough to fill the pod with data.) If things still look good, that drive goes on the buy list. When the price is right, we buy it.

We are willing to spend a little bit more on drives that are reliable, because it costs money to replace a drive. We are not willing to spend a lot more, though.

Excluded Drives

Some drives just don't work in the Backblaze environment. We have not included them in this study. It wouldn't be fair to call a drive 'bad' if it's just not suited for the environment it's put into.

We have some of these drives running in storage pods, but are in the process of replacing them because they aren't reliable enough. When one drive goes bad, it takes a lot of work to get the RAID back on-line if the whole RAID is made up of unreliable drives. It's just not worth the trouble.

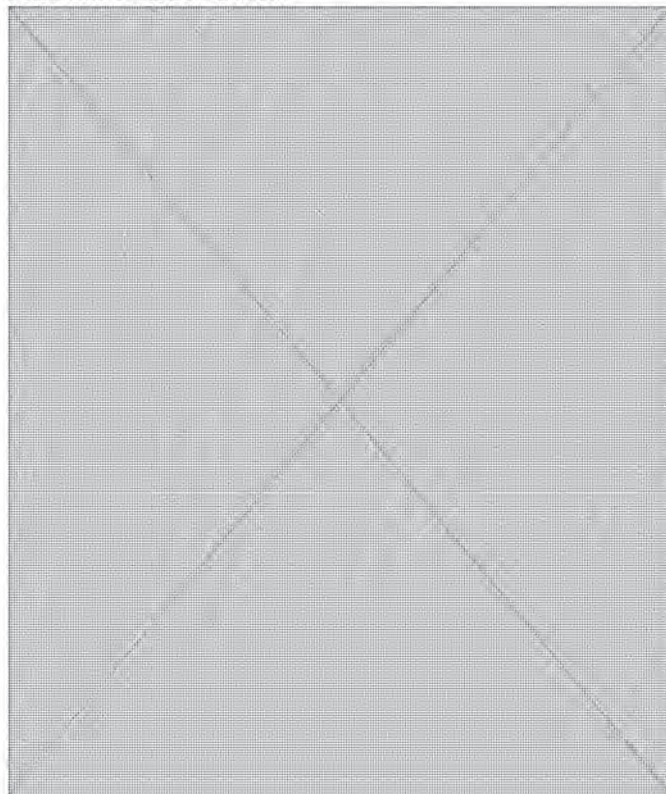
The drives that just don't work in our environment are Western Digital Green 3TB drives and Seagate LP (low power) 2TB drives. Both of these drives start accumulating errors as soon as they are put into production. We think this is related to vibration. The drives do somewhat better in the new low-vibration Backblaze Storage Pod, but still not well enough.

These drives are designed to be energy-efficient, and spin down aggressively when not in use. In the Backblaze environment, they spin down frequently, and then spin right backup. We think that this causes a lot of wear on the drive.

Failure Rates

We measure drive reliability by looking at the annual failure rate, which is the average number of failures you can expect running one drive for a year. A failure is when we have to replace a drive in a pod.

Annual Failure Rates



This chart has some more details that don't show up in the pretty chart, including the number of drives of each model that we have, and how old the drives are.

Number of Hard Drives by Model at Backblaze



Seagate Desktop HDD.15 (ST4000DM000)	4.0TB	5199	0.3	3.8%
Hitachi GST Deskstar 7K2000	2.0TB	4716	2.9	1.1%

(HDS722020ALA330)					
Hitachi GST Deskstar 5K3000 (HDS5C3030ALA630)	3.0TB	4592	1.7	0.9%	
Seagate Barracuda (ST3000DM001)	3.0TB	4252	1.4	9.8%	
Hitachi Deskstar 5K4000 (HDS5C4040ALE630)	4.0TB	2587	0.8	1.5%	
Seagate Barracuda LP (ST31500541AS)	1.5TB	1929	3.8	9.9%	
Hitachi Deskstar 7K3000 (HDS723030ALA640)	3.0TB	1027	2.1	0.9%	
Seagate Barracuda 7200 (ST31500341AS)	1.5TB	539	3.8	25.4%	
Western Digital Green (WD10EADS)	1.0TB	474	4.4	3.6%	
Western Digital Red (WD30EFRX)	3.0TB	346	0.5	3.2%	
Seagate Barracuda XT (ST33000651AS)	3.0TB	293	2.0	7.3%	
Seagate Barracuda LP (ST32000542AS)	2.0TB	288	2.0	7.2%	
Seagate Barracuda XT (ST4000DX000)	4.0TB	179	0.7	n/a	
Western Digital Green (WD10EACS)	1.0TB	84	5.0	n/a	
Seagate Barracuda Green (ST1500DL003)	1.5TB	51	0.8	120.0%	

The following sections focus on different aspects of these results.

1.5TB Seagate Drives

The Backblaze team has been happy with Seagate Barracuda LP 1.5TB drives. We've been running them for a long time - their average age is pushing 4 years. Their overall failure rate isn't great, but it's not terrible either.

The non-LP 7200 RPM drives have been consistently unreliable. Their failure rate is high, especially as they're getting older.

1.5TB Seagate Drives Used by Backblaze



Seagate Barracuda LP (ST31500541AS)	1.5TB	1929	3.8	9.9%
Seagate Barracuda 7200 (ST31500341AS)	1.5TB	539	3.8	25.4%
Seagate Barracuda Green (ST1500DL003)	1.5TB	51	0.8	120.0%

The Seagate Barracuda Green 1.5TB drive, though, has not been doing well. We got them from Seagate as warranty replacements for the older drives, and these new drives are dropping like flies. Their average age shows 0.8 years, but since these are warranty replacements, we believe that they are refurbished drives that were returned by other customers and erased, so they already had some usage when we got them.

Bigger Seagate Drives

The bigger Seagate drives have continued the tradition of the 1.5Tb drives: they're solid workhorses, but there is a constant attrition as they wear out.

2.0 to 4.0 TB Seagate Drives Used by Backblaze

Seagate Desktop HDD.15 (ST4000DM000)	4.0TB	5199	0.3	3.8%
Seagate Barracuda (ST3000DM001)	3.0TB	4252	1.4	9.8%
Seagate Barracuda XT (ST33000651AS)	3.0TB	293	2.0	7.3%
Seagate Barracuda LP (ST32000542AS)	2.0TB	288	2.0	7.2%
Seagate Barracuda XT (ST4000DX000)	4.0TB	179	0.7	n/a

The good pricing on Seagate drives along with the consistent, but not great, performance is why we have a lot of them.

Hitachi Drives

If the price were right, we would be buying nothing but Hitachi drives. They have been rock solid, and have had a remarkably low failure rate.

Hitachi Drives Used by Backblaze



Hitachi GST Deskstar 7K2000 (HDS722020ALA330)	2.0TB	4716	2.9	1.1%
Hitachi GST Deskstar 5K3000 (HDS5C3030ALA630)	3.0TB	4592	1.7	0.9%
Hitachi Deskstar 5K4000 (HDS5C4040ALE630)	4.0TB	2587	0.8	1.5%
Hitachi Deskstar 7K3000 (HDS723030ALA640)	3.0TB	1027	2.1	0.9%

Western Digital Drives

Back at the beginning of Backblaze, we bought Western Digital 1TB drives, and that was a really good choice. Even after over 4 years of use, the ones we still have are going strong.

We wish we had more of the Western Digital Red 3TB drives (WD30EFRX). They've also been really good, but they came after we already had a bunch of the Seagate 3TB drives, and when they came out their price was higher.

Western Digital Drives Used by Backblaze



Western Digital Green (WD10EADS)	1.0TB	474	4.4	3.6%
Western Digital Red (WD30EFRX)	3.0TB	346	0.5	3.2%
Western Digital Green (WD10EACS)	1.0TB	84	5.0	n/a

What About Drives That Don't Fail Completely?

Another issue when running a big data center is how much personal attention each drive needs. When a drive has a problem, but doesn't fail completely, it still creates work. Sometimes automated recovery can fix this, but sometimes a RAID array needs that personal touch to get it running again.

Each storage pod runs a number of RAID arrays. Each array stores data reliably by spreading data across many drives. If one drive fails, the data can still be obtained from the others. Sometimes, a drive may 'pop out' of a RAID array but still seem good, so after checking that its data is intact and it's working, it gets put back in the RAID to continue operation. Other times a drive may stop responding completely and look like it's gone, but it can be reset and continue running.

Measuring the time spent in a 'trouble' state like this is a measure of how much work a drive creates. Once again, Hitachi wins. Hitachi drives get 'four nines' of untroubled operation time, while the other brands just get 'two nines'.

Untroubled Operation of Drives by Manufacturer used at Backblaze

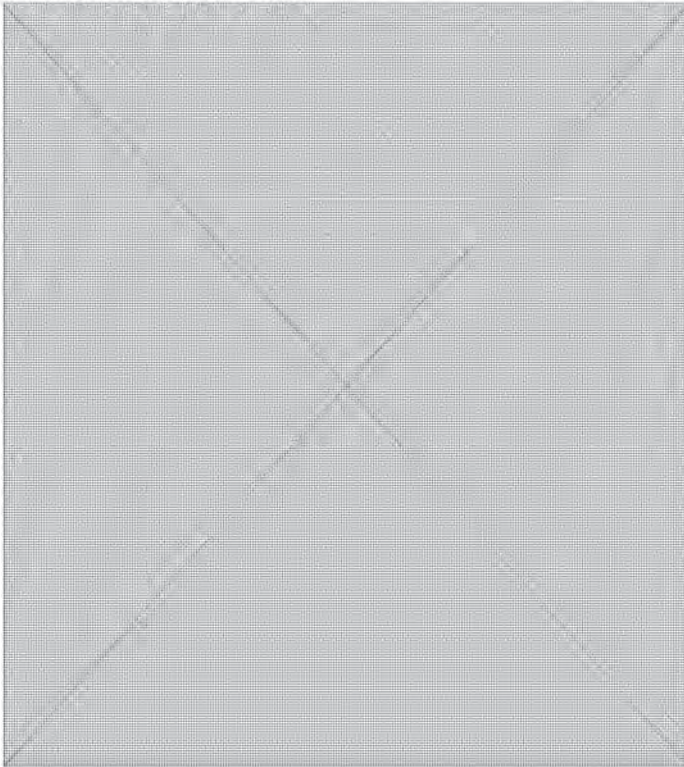


Seagate	99.72	0.28%	12459
Western Digital	99.83	0.17%	933
Hitachi	99.99	0.01%	12956

Drive Lifetime by Brand

The chart below shows the cumulative survival rate for each brand. Month by month, how many of the drives are still alive?

36-Month Survival Rate



Hitachi does really well. There is an initial die-off of Western Digital drives, and then they are nice and stable. The Seagate drives start strong, but die off at a consistently higher rate, with a burst of deaths near the 20-month mark.

Having said that, you'll notice that even after 3 years, by far most of the drives are still operating.

What Drives Is Backblaze Buying Now?

We are focusing on 4TB drives for new pods. For these, our current favorite is the Seagate Desktop HDD.15 (ST4000DM000). We'll have to keep an eye on them, though. Historically, Seagate drives have performed well at first, and then had higher failure rates later.

Our other favorite is the Western Digital 3TB Red (WD30EFRX).

We still have to buy smaller drives as replacements for older pods where drives fail. The drives we absolutely won't buy are Western Digital 3TB Green drives and Seagate 2TB LP drives.

A year and a half ago, Western Digital acquired the Hitachi disk drive business. Will Hitachi drives continue their excellent performance? Will Western Digital bring some of the Hitachi reliability into their consumer-grade drives?

At Backblaze, we will continue to monitor and share the performance of a variety of disk drive models. What has your experience been?

Our Comments

We read some negative comments on this report in the US press.

Under the title, *Dispelling Backblaze's HDD Reliability Myth - The Real Story Covered: We chronicle Backblaze's failed attempt to provide credible HDD reliability data. Read on to find out why you should pay no attention at all*

TweakTown wrote:

"Needless to say, there are holes in the methodology big enough to drive a truck through.

"They don't explain the test environment.

"The data from Backblaze should not influence a purchasing decision by any consumer, regardless of what type of drive they are purchasing. The innumerable variables, and lack of documentation, ensures the results are unreliable. Even for the winners, the results aren't good; the failure rates are exponentially higher than those observed in the real-world. One should question whether these companies could survive financially with the massive warranty return rates in real-world scenarios."

Under the title, *Selecting a Disk Drive: How Not to Do Research*
enterprisestorageforum.com wrote:

"I wasn't impressed last week when I saw Brian Beach's blog on what disk drive to buy. I wasn't impressed due to the lack of intellectual rigor in the analysis of the data he presented. In my opinion, clearly Beach has something else going on or lacks understanding of how disk drives and the disk drive market work.

"There is nothing in the blog about how much data is written to a set of drives that has had failures."

These comments are not fair.

We congratulate Backblaze for its report as it's the first time to our knowledge that a big user of HDDs published statistics on the reliability of HDDs based on a significant number of devices (25,000) and giving the names of the manufacturers with the precise models. And you cannot suspect Backblaze not to be independent from HDD makers as it runs devices from all of them. If nobody did a research like that, main reason is probably that big users prefer to keep good relationship with their suppliers.

For sure Backblaze published its report to promote its company. But why not?

And at the end, the final ranking in term of reliability (1/ HGST, 2/ WD, 3/ Seagate) is not surprising.

We suggest US commentators to buy 25,000 HDDs, keep them running them for several years and reveal their own results to prove Backblaze is wrong.

We also heard that HDD makers were not happy at all after reading the Backblaze report. For them, we suggest that they reveal their own numbers concerning the hard disk drives they were obliged to replace before the end of the warranty these last years. For sure, they have these statistics. But up to know they never publicly released this information. Do it and once more prove that the Backblaze results are wrong.

----- Forwarded message -----

From: **Robert Volpe** <robert.volpe@seagate.com>

Date: Fri, Jan 31, 2014 at 2:35 PM

Subject: Most Reliable HDDs After Analyzing 25,000 Units - Backblaze

To: Wanda W Pearson <wanda.w.pearson@seagate.com>, Noelle Currell <noelle.currell@seagate.com>

FYI

<http://www.storagenewsletter.com/rubriques/market-reportsresearch/most-reliable-hdds-after-analyzing-25000-units-backblaze/>

Rob Volpe
Director, Global Operations Strategy
Seagate Technology
Office Telephone: 720-684-1988
US Cell Phone: 303-351-1110

EXHIBIT 28

HIGHLY CONFIDENTIAL

1 SHEPPARD, MULLIN, RICHTER & HAMPTON LLP
 A Limited Liability Partnership
 2 Including Professional Corporations
 NEIL A.F. POPOVIC, Cal. Bar No. 132403
 3 ANNA S. McLEAN, Cal. Bar No. 142233
 TENAYA RODEWALD, Cal. Bar No. 248563
 4 MUKUND H. SHARMA, Cal. Bar No. 249125
 LIEN H. PAYNE, Cal. Bar No. 291569
 5 JOY O. SIU, Cal. Bar No. 307610
 Four Embarcadero Center, 17th Floor
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 8 amclean@sheppardmullin.com
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 9 msharma@sheppardmullin.com
 lpayne@sheppardmullin.com
 10 jsiu@sheppardmullin.com

11 Attorneys for Defendant,
 SEAGATE TECHNOLOGY, LLC
 12

13 UNITED STATES DISTRICT COURT
 14 NORTHERN DISTRICT OF CALIFORNIA
 15 SAN FRANCISCO DIVISION
 16

17 IN RE SEAGATE TECHNOLOGY, LLC
 18 LITIGATION

Case No. 3:16-cv-00523 JCS

19 CONSOLIDATED ACTION
 20
 21

**DEFENDANT SEAGATE TECHNOLOGY
 LLC'S SUPPLEMENTAL RESPONSES
 TO PLAINTIFF CHRISTOPHER
 NELSON'S FIRST SET OF
 INTERROGATORIES**

22 PROPOUNDING PARTY: PLAINTIFF CHRISTOPHER NELSON
 23

24 RESPONDING PARTY: SEAGATE TECHNOLOGY, LLC
 25

26 SET NO.: ONE
 27
 28

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1 Defendant Seagate Technology LLC (“Seagate”) hereby supplements its responses
2 to Interrogatories Number 1, 2, and 8 in the First Set of Interrogatories propounded by plaintiff
3 Christopher Nelson (“Plaintiff”).

4 **GENERAL STATEMENT AND OBJECTIONS**

5 **GENERAL OBJECTIONS**

6 1. The following responses are made solely for purposes of this action. Each response
7 is subject to all objections as to competence, relevance, materiality, propriety and admissibility,
8 and any and all other objections and grounds which would require the exclusion of any statements
9 contained herein, if such statements were made by a witness present and testifying at court, all of
10 which objections and grounds are reserved and may be interposed at the time of trial.

11 2. The following responses are based upon information presently available to Seagate.
12 Seagate is not making any incidental or implied admissions regarding the contents of these
13 responses. Seagate’s objections, and any subsequent responses, are at all times subject to such
14 additional or different information as may result from further discovery, investigation, and/or
15 refreshing of recollection. Seagate reserves the right to alter, amend, or supplement any responses
16 it makes to Plaintiff’s First Set of Interrogatories. Seagate reserves the right to make any use of,
17 or to introduce at any hearing and at trial, information responsive to the First Set of
18 Interrogatories, but discovered subsequent to the date of any responses to the First Set of
19 Interrogatories, including, but not limited to, any such information obtained in discovery herein.
20 The fact that Seagate has answered part or all of any Interrogatory is not intended to and shall not
21 be construed to be a waiver by Seagate of all or any part of any objections to any Interrogatory.

22 3. Seagate objects to the Interrogatories to the extent they seek information outside
23 the possession, custody, or control of Seagate and that is not within Seagate’s personal knowledge.
24
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OBJECTIONS TO DEFINITIONS

1
2 1. Seagate objects to the definition of SEAGATE or YOU as overbroad to the extent
3 Plaintiffs purport to ask for privileged information from Seagate attorneys.

RESPONSES TO INTERROGATORIES**INTERROGATORY NO. 1:**

6 State the total annual unit sales, by year and by state, of Hard Drives sold within
7 the United States.

SUPPLEMENTAL RESPONSE TO INTERROGATORY NO. 1:

9 Seagate incorporates the General Objections set forth above to the extent
10 applicable. Seagate objects to this interrogatory because it is premature and seeks information
11 irrelevant to class certification or liability. Seagate further objects to this interrogatory because it
12 seeks sensitive commercial and business information protected by California law. Subject to and
13 without waiving the foregoing objections, Seagate responds as follows:

14 Pursuant to the Parties' meet and confer agreement, Seagate agreed to, and did,
15 provide data responsive to this interrogatory for each of the Drives identified in the Second
16 Consolidated Amended Complaint ("SCAC") by year pursuant to state and federal mediation
17 privileges. *Cf.* Fed. R. Evid. 501 ("[I]n a civil case, state law governs privilege regarding a claim
18 or defense for which state law supplies the rule of decision."); Cal. Evid. Code §§ 1115 *et seq.*; *see*
19 *also* Fed. R. Evid. 408 (protecting conduct and communications made for purposes of offers of
20 compromise or negotiations).

21 In Table 1 below, Seagate provides total annual net unit sales in the U.S. of
22 products containing drive model number ST3000DM001. Sales data from September 2011
23 through December 2011 are subject to change, and Seagate is working to confirm these data.
24 Seagate does not track sales of consumer products to consumers on a state-by-state basis.

INTERROGATORY NO. 2:

26 State the total annual revenue, by year and by state, from sales of Hard Drives
27 within the United States.

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SUPPLEMENTAL RESPONSE TO INTERROGATORY NO. 2:

Seagate incorporates the General Objections set forth above to the extent applicable. Seagate objects to this interrogatory because it is premature and seeks information irrelevant to class certification or liability. Seagate further objects to this interrogatory because it seeks sensitive commercial and business information protected by California law. Subject to and without waiving the foregoing objections, Seagate responds as follows:

Pursuant to the Parties' meet and confer agreement, Seagate agreed to, and did, provide data responsive to this interrogatory for each of the Drives identified in the SCAC by year pursuant to the mediation privilege. *Cf.* Fed. R. Evid. 501 ("[I]n a civil case, state law governs privilege regarding a claim or defense for which state law supplies the rule of decision."); Cal. Evid. Code §§ 1115 *et seq.*; *see also* Fed. R. Evid. 408 (protecting conduct and communications made for purposes of offers of compromise or negotiations).

In Table 2 below, Seagate provides the total annual net revenues in the U.S. of drives containing drive model number ST3000DM001. Sales data from September 2011 through December 2011 are subject to change, and Seagate is working to confirm these data. Seagate does not track sales of consumer products to consumers on a state-by-state basis.

INTERROGATORY NO. 8:

State the total annual revenue, by year and by state, from any recovery services paid to You by consumers for Hard Drives sold in the United States.

SUPPLEMENTAL RESPONSE TO INTERROGATORY NO. 8:

Seagate incorporates the General Objections set forth above to the extent applicable. Seagate objects to this interrogatory to the extent that it seeks sensitive commercial and business information protected by California law. Seagate further objects to this interrogatory on grounds that it seeks information related to consequential damages, which are not recoverable, and thus not relevant to Plaintiff's claims or defenses. As such, the interrogatory falls outside the permissible scope of discovery. Seagate further objects to this interrogatory to the extent it seeks confidential consumer information protected by the California Constitution. Subject to and without waiving the foregoing objections, Seagate responds as follows:

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1 Pursuant to the Parties' meet and confer agreement, Seagate agreed to, and did,
2 provide data responsive to this interrogatory for each of the Drives identified in the SCAC by year
3 pursuant to state and federal mediation privileges. *Cf.* Fed. R. Evid. 501 ("[I]n a civil case, state
4 law governs privilege regarding a claim or defense for which state law supplies the rule of
5 decision."); Cal. Evid. Code §§ 1115 *et seq.*; *see also* Fed. R. Evid. 408 (protecting conduct and
6 communications made for purposes of offers of compromise or negotiations).

7 Seagate further responds that its customers have paid approximately \$674,225 for
8 data recovery charges through May 2017, with filters applied to eliminate obvious institutional
9 customers (businesses, non-profits, government entities, educational institutions) and non-US
10 customers.

11 Dated: August 18, 2017

12 SHEPPARD, MULLIN, RICHTER & HAMPTON LLP

13
14 By

/s/ Anna S. McLean

NEIL A.F. POPOVIC

ANNA S. McLEAN

MUKUND H. SHARMA

TENAYA RODEWALD

LIÊN H. PAYNE

JOY O. SIU

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19 Attorneys for Defendant
20 SEAGATE TECHNOLOGY, LLC
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Table 1: U.S. Net Unit Sales of Drives Containing Drive Model Number ST3000DM001

Year	Business 1 Bay NAS	Business 2 Bay NAS	Business 4 Bay NAS	D3 Station	Desktop Ext. Drive	Barracuda – Desktop Internal HDD Kit.	FreeAgent GoFlex Desk	FreeAgent GoFlex Home	GoFlex Desk For Mac	Backup Plus Desk	Backup Plus Mac	Seagate Expansion Desk	Seagate Expansion Desk Plus
2011	0	0	0	0	34,651	11371	100,046	14,663	1,071	0	0	0	0
2012	0	0	0	0	29,389	52093	161,691	41,196	3,610	304,921	6,527	62,959	0
2013	843	1,074	956	15,917	-61	47499	-2,138	-1,563	1,377	377,644	11,130	138,542	12,657
2014	1,017	590	441	29,913	0	46234	-507	-112	-8	171,329	15,607	94,609	30,023
2015	110	21	39	20,683	0	56541	-6	-2	0	67,714	14,452	133,036	28,106
2016	0	0	-7	2,383	0	34067	-1	0	0	49,092	11,942	28,135	8,162
2017*	0	0	0	-2	0	6760	0	0	0	17,194	-55	19,698	-17
Total	1,970	1,685	1,429	68,894	63,979	254,565	259,085	54,182	6,050	987,894	59,603	476,979	78,931

* Data for 2017 is through May 2017.

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Table 2: U.S. Net Revenues of Drives Containing Drive Model Number ST3000DM001

Year	Business 1 Bay NAS	Business 2 Bay NAS	Business 4 Bay NAS	D3 Station	Desktop Ext. Drive	Barracuda – Desktop Internal HDD Kit.	FreeAgent GoFlex Desk	FreeAgent GoFlex Home	GoFlex Desk For Mac	Backup Plus Desk	Backup Plus Mac	Seagate Expansion Desk	Seagate Expansion Desk Plus
2011	\$0	\$0	\$0	\$0	\$5,048,232	\$2,103,833	\$16,034,150	\$2,588,140	\$173,308	\$0	\$0	\$0	\$0
2012	\$0	\$0	\$0	\$0	\$3,619,747	\$7,983,201	\$21,868,334	\$6,404,085	\$909,077	\$38,697,219	\$982,128	\$7,494,081	\$0
2013	\$156,200	\$432,325	\$770,780	\$1,840,595	-\$6,824	\$6,040,590	-\$179,563	-\$231,704	\$121,539	\$42,714,613	\$1,473,181	\$14,753,524	\$1,265,700
2014	\$190,618	\$224,318	\$333,594	\$3,134,456	\$0	\$5,136,694	-\$35,039	-\$21,381	-\$3,922	\$18,697,510	\$1,715,618	\$9,671,078	\$2,981,410
2015	\$21,189	\$8,568	\$29,978	\$2,176,874	\$0	\$5,664,510	-\$213	-\$153	\$0	\$7,416,248	\$1,592,631	\$13,856,740	\$2,667,158
2016	\$0	\$0	-\$4,380	\$226,365	\$0	\$2,975,799	-\$11	\$0	\$0	\$4,061,881	\$1,112,226	\$2,401,176	\$615,443
2017*	\$0	\$0	\$0	-\$190	\$0	\$577,560	\$0	\$0	\$0	\$1,295,199	-\$5,143	\$1,570,729	-\$1,273
Total	\$368,006	\$665,211	\$1,129,971	\$7,378,100	\$8,661,155	\$30,482,188	\$37,687,659	\$8,738,987	\$1,200,003	\$112,882,671	\$6,870,641	\$49,747,327	\$7,528,438

* Data for 2017 is through May 2017.

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VERIFICATION

UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA
SAN FRANCISCO DIVISION

I have read the foregoing DEFENDANT SEAGATE TECHNOLOGY, LLC'S
SUPPLEMENTAL RESPONSES TO PLAINTIFFS' FIRST SET OF INTERROGATORIES and
know its contents.

I am the Director of Supply Chain of Seagate Technology, LLC, a party
to this action, and am authorized to make this verification for and on its behalf, and I make this
verification for that reason. I am informed and believe and on that ground allege that the matters
stated in the foregoing document are true.

I declare under penalty of perjury under the laws of the State of California that the
foregoing is true and correct.

Executed on August 10, 2017, at Cupertino, California.

Scott Robbeleth
Print Name of Signatory


Signature

PROOF OF SERVICE
In re Seagate Technology LLC Litigation
USDC Case No. 5:16-cv-00523-JCS

I am over eighteen years old, not a party to the within action, and made the following service from my place of employment—Sheppard, Mullin, Richter & Hampton, 379 Lytton Ave., Palo Alto, CA 94301. On August 18, 2017, I served the following document:

DEFENDANT SEAGATE TECHNOLOGY, LLC'S SUPPLEMENTAL
RESPONSES TO PLAINTIFF'S FIRST SET OF INTERROGATORIES

in pdf format from my email address (msharma@sheppardmullin.com) to the persons at the email addresses listed below:

- **Steve W. Berman**
steve@hbsslaw.com; heatherw@hbsslaw.com; nicolleg@hbsslaw.com;
josephs@hbsslaw.com;
- **Jeff D Friedman**
jefff@hbsslaw.com; jeanethd@hbsslaw.com; sf_filings@hbsslaw.com;
nicolleg@hbsslaw.com
- **Shana E. Scarlett**
shanas@hbsslaw.com
- **Bryan L. Clobes**
bclobes@caffertyclobes.com
- **Marc Adam Goldich**
mgoldich@axgolaw.com; mstrout@axgolaw.com
- **Ashley A. Bede**
AshleyB@hbsslaw.com
- **Noah Axler**
naxler@axgolaw.com
- **Nyran Rose Rasche**
nrasche@caffertyclobes.com, docket@caffertyclobes.com, snyland@caffertyclobes.com

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct and that I am employed in the office of a member of the bar of this Court at whose direction the service was made.

Executed on August 18, 2017, at Palo Alto, California.

/s/ Mukund H. Sharma
Mukund H. Sharma

EXHIBIT 36

Subject: [ChatID Analytics] Weekly Transcripts for Seagate
From: no-reply@chatid.com
To: jon.spencer@seagate.com, yvonne.schmidt@seagate.com,
marianne@chatid.com, christopher.davis@seagate.com,
shenedra.wiley@seagate.com, blair.billingsley@seagate.com
ChatID Moderation Transcripts-2016-05-16-0000-2016-05-23-0000 all chats.xlsx

See attached files

No tiff included for this record.

Prepared for Seagate on 2016-05-23 13:01:15.162497 covering 2016-05-16--2016-05-23

Version: 1.3.16

	A	B	C	D	E
1	Room ID	Chat Session ID	ChatID of Chat Agent	Channel	Start Time
			seagate	neweggbusiness	2016-05-16 18:50:15.653800-04:00
4					

Prepared for Seagate on 2016-05-23 13:01:15.162497 covering 2016-05-16--2016-05-23
Version: 1.3.16

	F	G	H	I	J
1	Conversation End Time	Duration of Conversation (seconds)	Agent Nicknames	User Wait (Start Chat to Agent Message)	Average Agent Response Time During Conversation
4	2016-05-16 19:02:55.776600-04:00	221.58	Scott A	27.41	12.55

Prepared for Seagate on 2016-05-23 13:01:15.162497 covering 2016-05-16--2016-05-23
Version: 1.3.16

	K	L	M	N	O
1	Page Title	Page URL	Post-Chat Survey Score	Product Categories	Product Brand
4	NeweggBusiness - Seagate NAS HDD ST2000VN000 2TB 64MB Cache SATA 6.0Gb/s Internal Hard Drive	http://www.neweggbusiness.com/Product/Product.aspx?Item=9B-22-178-391&nm_mc=KNC-GoogleBiz-PC&cm_mmc=KNC-GoogleBiz-PC-_-pla-_-Hard+Drives-_-9B-22-178-391&gclid=CMGRvs3P38wCFYkvgQodXkwKEg	1	Data Storage; Hard Drives; Desktop Internal Hard Drives; Seagate	Seagate

Prepared for Seagate on 2016-05-23 13:01:15.162497 covering 2016-05-16--2016-05-23
Version: 1.3.16

	P	Q	R	S	T
1	Product Price	Message 1	Message 2	Message 3	Message 4
4	81.99	Scott A: Hello. Thank you for contacting Seagate on Newegg.com. My name is Scott. How may I be of assistance?	Scott A: Are you there or have we been disconnected? This chat has been idle for 2 minutes and will be disconnected in one minute if there is no activity.	Scott A: Thank you for contacting Seagate on Newegg.com. We value your opinion and hope you can take the 1-question survey following this chat. Have a great day and let us know if we can help you with anything else.	Zach G: Hello. Thank you for contacting Seagate on Newegg.com. My name is Zach. How may I be of assistance?

Prepared for Seagate on 2016-05-23 13:01:15.162497 covering 2016-05-16--2016-05-23
Version: 1.3.16

	U	V	W	X	Y
1	Message 5	Message 6	Message 7	Message 8	Message 9
4	Visitor: how long is the warrnty since drive rarley last	Zach G: The warranty on the NAS HDD is 3 years, as indicated under Warranty & Returns	Visitor: can I ask why seagate drive seem to have a high failure rate?	Zach G: I would not have an answer for that as we have not seen that to be the case.	Visitor: of course you are gonna say that

Prepared for Seagate on 2016-05-23 13:01:15.162497 covering 2016-05-16--2016-05-23

Version: 1.3.16

	Z	AA	AB	AC	AD
1	Message 10	Message 11	Message 12	Message 13	Message 14
4	Zach G: When used in the environment they are designed for, our drives have shown to have failure rates consistent with any other.	Visitor: i have 4 1tb drive that have failed	Zach G: I am sorry to hear that.	Visitor: thats ok I will choose another brand for this purchase I need something reliable	Zach G: I understand. Is there anything else I can help you with?

Prepared for Seagate on 2016-05-23 13:01:15.162497 covering 2016-05-16--2016-05-23

Version: 1.3.16

	AE	AF
1	Message 15	Message 16
4	Visitor: wow great have a nice day	Zach G: Thank you for contacting Seagate via Newegg. Have a good day

EXHIBIT 38



Seagate Technology LLC
10200 S. De Anza Blvd.
Cupertino, CA 95014

August 27, 2014

**To: Seagate AMERICAS-Latin AMERICA Authorized Distributors
Authorized for Seagate Retail Product Lines**

**Re: Key Retail Customer Program for Seagate® Retail Products sold to Eligible Retail Customers -
REVISION**

REVISION NOTE: This Program supersedes and replaces Program Number Q115175r2KRC in order to update the Eligible Customers Table in Appendix A. Changes have been noted in **Green** text.

The Seagate Key Retail Customer ("KRC") Program is designed to better serve qualified Authorized Reseller Customers who purchase Seagate retail products from Seagate Authorized Distributors ("you") and therefore, assist your business development.

Program Name	Seagate Key Retail Customer Program
Program Period	Start Date: Saturday, August 2, 2014 End Date: Friday, September 5, 2014
Eligible Products	See Eligible Products and Rebates Table below
Eligible Customers	See Table of Authorized Reseller Customers in Appendix A
Letter Number	Q115175r3KRC

Program Details:

You are eligible to receive a rebate for each Eligible Product sold during the Program Period, as detailed in the table below. Only sales to Eligible Authorized Reseller Customers listed in **Appendix A** will count towards Program calculation.

Eligible Products and Rebates:

Product Name	Model Number	Cap (GB)	Rebate (US\$)
Backup Plus Portable Drive - Black	STDR1000100	1000	\$ 7.00
Backup Plus Portable Drive - Silver	STDR1000101	1000	\$ 7.00
Backup Plus Portable Drive - Blue	STDR1000102	1000	\$ 7.00
Backup Plus Portable Drive - Red	STDR1000103	1000	\$ 7.00
Backup Plus Portable Drive - Black	STDR2000100	2000	\$ 25.00
Backup Plus Portable Drive - Silver	STDR2000101	2000	\$ 25.00
Backup Plus Portable Drive - Blue	STDR2000102	2000	\$ 25.00
Backup Plus Portable Drive - Red	STDR2000103	2000	\$ 25.00
Seagate® Expansion™ Portable Drive USB 3.0	STBX500100	500	\$ 7.50
Seagate® Expansion™ Portable Drive USB 3.0	STBX1000101	1000	\$ 3.50
Seagate® Expansion™ Portable Drive USB 3.0	STBX2000401	2000	\$ 20.00
Seagate® Expansion™ Desktop Drive USB 3.0	STBV2000100	2000	\$ 7.50
Seagate® Expansion™ Desktop Drive USB 3.0	STBV2000200	2000	\$ 7.50
Seagate® Expansion™ Desktop Drive USB 3.0	STBV3000100	3000	\$ 7.00
Seagate® Expansion™ Desktop Drive USB 3.0	STBV3000200	3000	\$ 7.00
Seagate® Expansion™ Desktop Drive USB 3.0	STBV4000100	4000	\$ 12.50
Seagate® Expansion™ Desktop Drive USB 3.0	STBV4000200	4000	\$ 12.50
Seagate® Expansion™ Desktop Drive USB 3.0	STBV5000100	5000	\$ 10.00
Seagate® Expansion™ Desktop Drive USB 3.0	STBV5000200	5000	\$ 10.00
Central	STCG2000100	2000	\$ 6.00
Central	STCG3000100	3000	\$ 9.00
Central	STCG4000100	4000	\$ 4.00

Q115175r3KRC_KeyRetailCustomer_STX_RTL_AMER_LA

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Q115175r3KRC-1268

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Program Requirements:

- For the Program Period indicated above, Seagate has determined the Eligible Authorized Reseller Customers and communicated their respective eligibility status. Appendix A lists Eligible Authorized Reseller Customers for this Program. Seagate may periodically revise the list of Eligible Authorized Reseller Customers.
- Eligible Products for this Program must be invoiced by you to the Eligible Authorized Reseller Customers listed in Appendix A within the Program Period.
- Seagate Sales Programs office will calculate your rebate based on Net Sales -Out and issue credit to you for eligible rebates approximately 30 days after the close of the Program Period.
 - Net Sales-Out or Net POS is defined as your reported Point of Sale (POS) invoice data less returns.

Additional Terms and Conditions:

- Program calculation is based on the number of units of Eligible Product your Eligible Authorized Reseller Customers purchased from you, less any returns.
- The Program is effective only while supplies last; no backorders will be honored.
- You are contractually required to electronically report Point of Sale (POS) and inventory data to Seagate on a daily basis. Late or missing POS or inventory data may not be included in the Program calculations.
- If you experience electronic connectivity issues preventing daily POS or inventory reporting, you must contact Zyme Solutions directly at seagate@zymesolutions.com. Please contact them immediately to provide an expected date of resolution. Late reporting or duplicate reporting of POS and inventory data will not be accepted without prior approval from Seagate.
- Only sales of Eligible Products to Eligible Authorized Reseller Customers (Appendix A) will be used to calculate your Program rebate.
- Seagate reserves the right to request copies of invoices or other supporting documentation relating to performance under this Program. The requested invoices must be received within seven calendar days of the original request.
- Seagate is not responsible for any administrative fees or taxes incurred in connection with this Program.
- Eligible Products sold under this Program are subject to the tax, customs and export control laws and regulations of the United States and may not be sold, leased or otherwise transferred to restricted countries, or used by a restricted end user or an end user engaged in activities related to weapons of mass destruction. It is your responsibility to comply with and abide by those laws and regulations, and the customs and tax laws and regulations of the country for which the product is destined.
- Seagate reserves the right to modify or cancel this Program at any time. This Program is void where prohibited.

If you have any questions regarding this Program, please contact your Seagate Representative.

Sincerely,



Frank Iarusci
Senior Director, Americas Sales & Marketing – Branded Solutions
Seagate Technology LLC

Eligible Reseller Customers
A & M CONNECTION INC
ATACADAO DO PAPEL LTDA
AURORA TRADING S.A.
AUSTIN CENTER S.A.
B2W COMPANHIA
BEST BUY LATIN AMERICA
CDC INTERNATIONAL S A
CECOMIL COM E SERV LTDA
COMPUDISKETT SRL
CTIS TECNOLOGIA SA
DATA COMPUTACION S R L
DIAMOND IT USA CORP.
DIGITAL INTEGRATORS
ECCO DO BRASIL INFORMATICA E ELETR LTDA
ESPANA INFORMATICA SA
EVOLUSOM COMERCIAL LTDA
F BRASIL LTDA
FAGUNDEZ DISTRIBUICAO LTDA
FAST SHOP COMERCIAL SA
FOURSERV
GARBARINO S.A.
GENERAL PROCUREMENT - LATIN AMERICA
GLOBAL ELECTRONIC S A
GOGEEK USA CORP
GRUPO DELTRON S.A.
IMPORTADORA Y DISTRIBUIDORA MACROTEL PERU
IMPORTADORA Y DISTRIBUIDORA MACROTEL CHILE
INFO STORE
INGRAM MICRO MEXICO SA DE CV
INTELAF S A
J.L CHAAR SIMAO
JAIR ELECTRONICS CORP
JUKEBOX S.A.
KABUM COMERCIO ELETRONICO SA
KALUNGA COMERCIO INDUSTRIA GRAFICA LTDA
LINALCA S A
MAGAZINE LUIZA SA
MAXIMA INTERNACIONAL S A.
MENSON CORP
MIAMI COMPUTER DISTRIBUTOR INC
MICRO INFORMATICA
MIRANDA COMPUTACAO E COMERCIO LTDA
MYATECH IND COMERCIO
NASA ELECTRONICS CORP
NSA INTERNATIONAL LLC
OFFICE DEPOT MEXICO
OFFICE MAX (OPERADORA OMX)
OMEGA TECH S.A.
PALACIO DE HIERRO
PANAMERICANA LIBRERIA Y PAPELERIA SA
PAQUETES Y PROGRAMAS HARDWARE Y SOFTWARE S A
PC ONLINE, S.A. DE C.V.
PC RETAIL SA
PERSONAL COMPUTER FACTORY LTDA
POWERPC LTDA
PRODISUR DE RIGSTAR S.A.
PROMOTORA MUSICAL S.A. DE C.V.
QUADDRIX TECHNOLOGY
QUARIAIX CORPORATION
RIGSTAR S.A. ROMA AUSTIN
RKL FUTURE IMPORT EXPORT LLC
SARAIVA E SICILIANO SA
SAZ COMPUTER INC
STISMAN FERNANDO PABLO
TECNO IND E COM DE COMPUTADORES LTDA
TIGERS DEL ESTE S A
TONIVISA MEXICO, S.A. DE C.V.
NUEVO WALMART MEXICO
WALMART CHILE COMERCIAL LTDA
WMB COMERCIO ELETRONICO LTDA

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Q115175r3KRC-1268

EXHIBIT 39



Seagate Technology
10200 S. DeAnza Blvd.
Cupertino, CA 95014
United States of America

December 6, 2011

To: Seagate Global Authorized Distributors
Re: Update to Seagate Bare Drive Product Warranty Periods

Dear Channel Partner,

Effective December 31, 2011, Seagate will be changing its warranty policy from a 5 year to a 3 year warranty period for Nearline drives, 2 years to 1 year for certain Desktop and Notebook Bare Drives (5 years to 3 years on Barracuda® XT and Momentus® XT), and from as much as 5 years to 2 years on Consumer Electronics (see table below.) The new warranty periods will apply to all shipments of applicable products, as of the effective date. Former warranty periods will be honored for all existing channel inventory shipped to you before the effective date.

At Seagate, we are standardizing warranty terms to be more consistent with those commonly applied throughout the consumer electronics and technology industries. By aligning to current industry standards, Seagate can continue to focus its investments on technology innovation and unique product features that drive value for our customers rather than holding long-term reserves for warranty returns.

Therefore, we are announcing our plan to change our warranty policy as follows:

Product Line	Limited Warranty Period (as of December 31, 2011)
Constellation®.2 and Constellation® ES.2	3 years
Barracuda® and Barracuda® Green 3.5" Drives	1 year
Barracuda® XT	3 years
Momentus® 2.5" Drives (5400 RPM & 7200 RPM)	1 year
Momentus® XT	3 years
SV35 Series™ - Video Surveillance	2 years
Pipeline HD® Mini, Pipeline HD®	2 years

Seagate will update its Global Limited Warranty Overview Policy as of December 31, 2011 specifically documenting these changes. The limited warranty included in your distributor agreement with Seagate will continue to apply to these products under the new warranty periods.

Products not impacted by this change include: Mission Critical and Retail products.

As always, we believe in strong communication with our channel partners and appreciate your support and loyalty. Please do not hesitate to contact your local Seagate sales manager if you have any questions, comments, or need any other type of assistance or information.

Sincerely,

Kurt Richarz
Executive Vice President
Sales, Marketing and Sales Operations
Seagate Technology LLC

Q212077COM_Warranty_Communication_BareDrive

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Q212077COM-0000

EXHIBIT 40



Seagate Product Update

June 26, 2013



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Agenda

Product line update

- Branded Innovation update
- Product philosophy
- Market overview & product updates



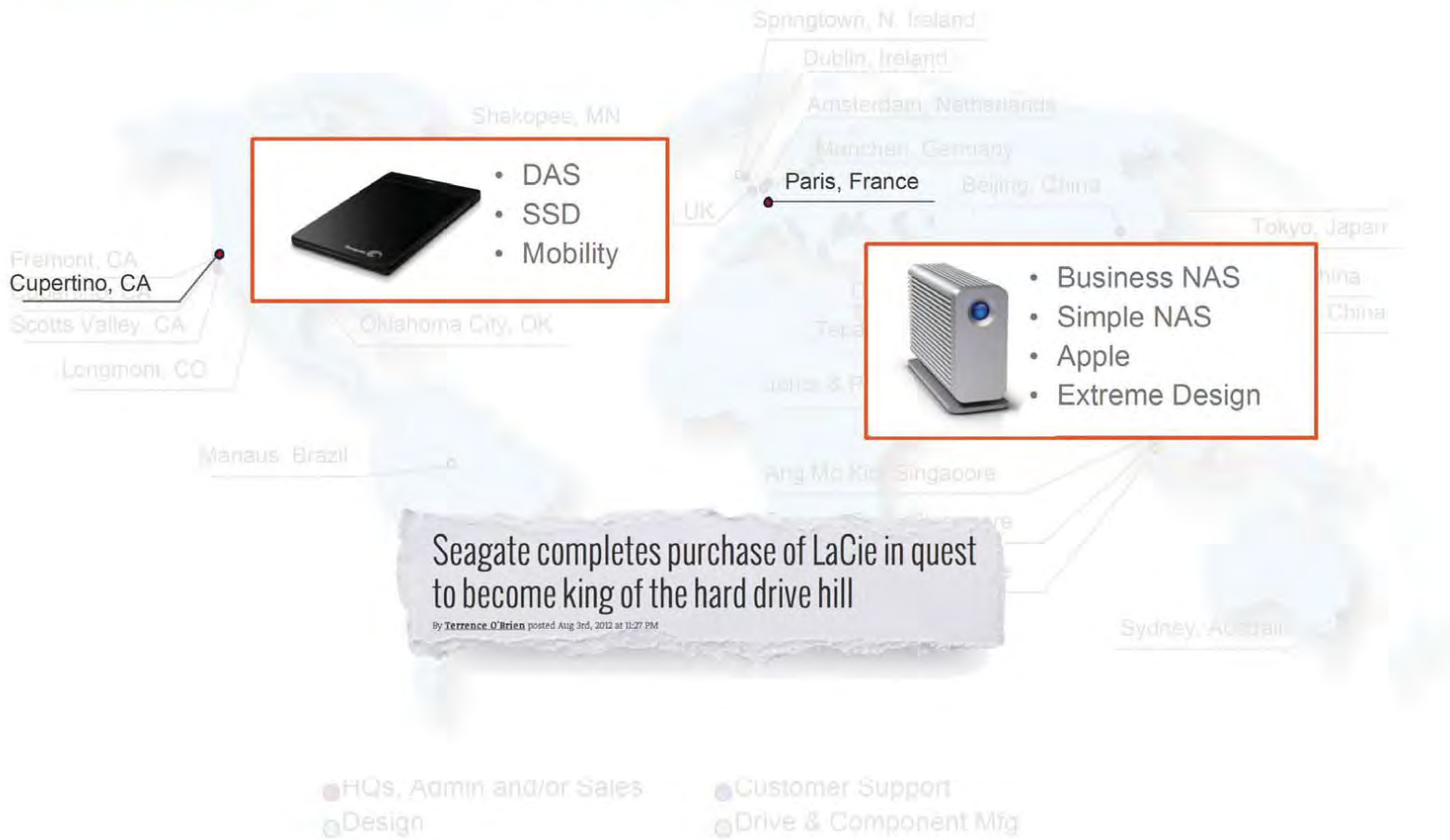
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Seagate Global Presence



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Product Design Process

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Driving The Product Generation Process

Segmentation	Market Technology & Trends	Other Input
		<ul style="list-style-type: none"> • Executive mandate • Corporate strategy • Competitive response • Business development opportunity • Output from engineering forums

Informing Product Decisions with Research

Research cycle for next-generation products

Product Validation

How do customers use/value our products?

- Exit surveys, registration data studies
- Refine follow-on products or updates
- Conducted following product launch

Product Studies

What is the value of a feature?

- Conjoint and focus studies
- Set product priorities
- Inform value proposition & GTM
- Conducted several times per year to support concept definition



Needs assessment

Who are target customers & what do they need?

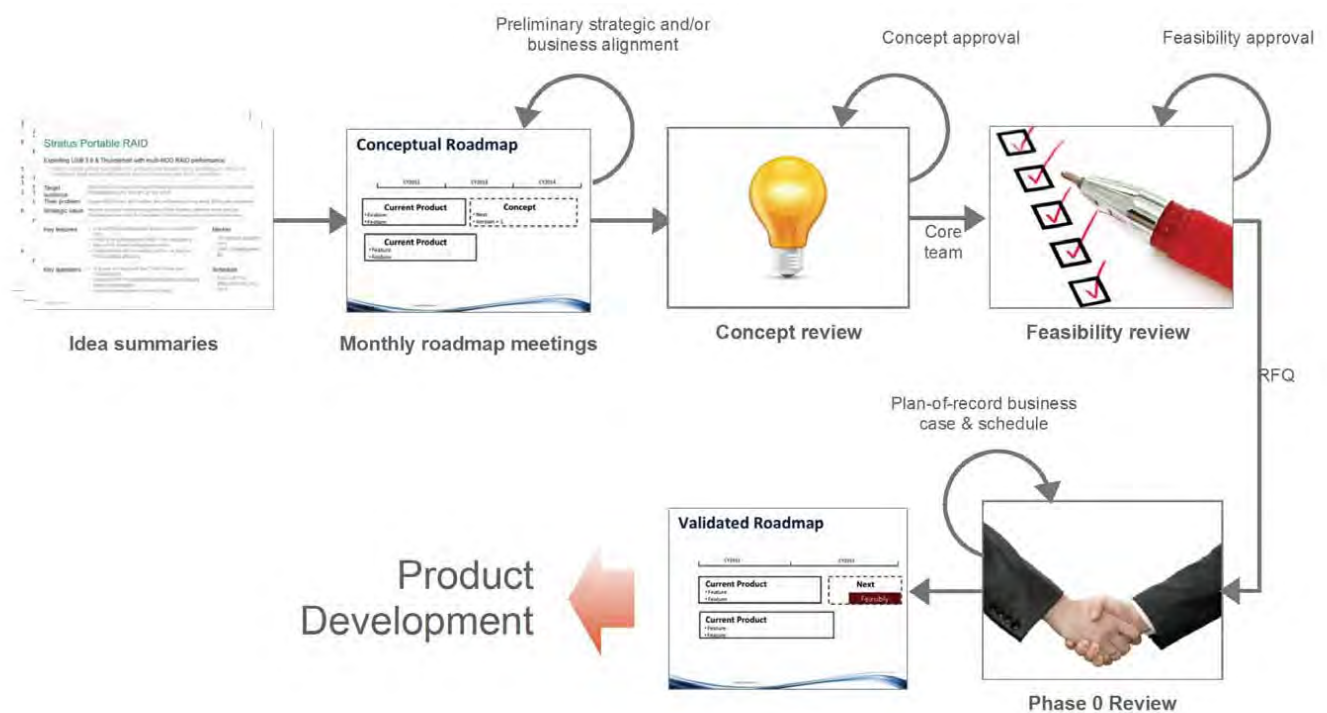
- Segmentation studies
- Refine personas & segmentation
- Understand & group by needs
- Conducted annually

Wave tracker

How do needs change over time?

- Wave studies
- Adjust personas or product targets
- Conducted quarterly

Roadmap Process Overview



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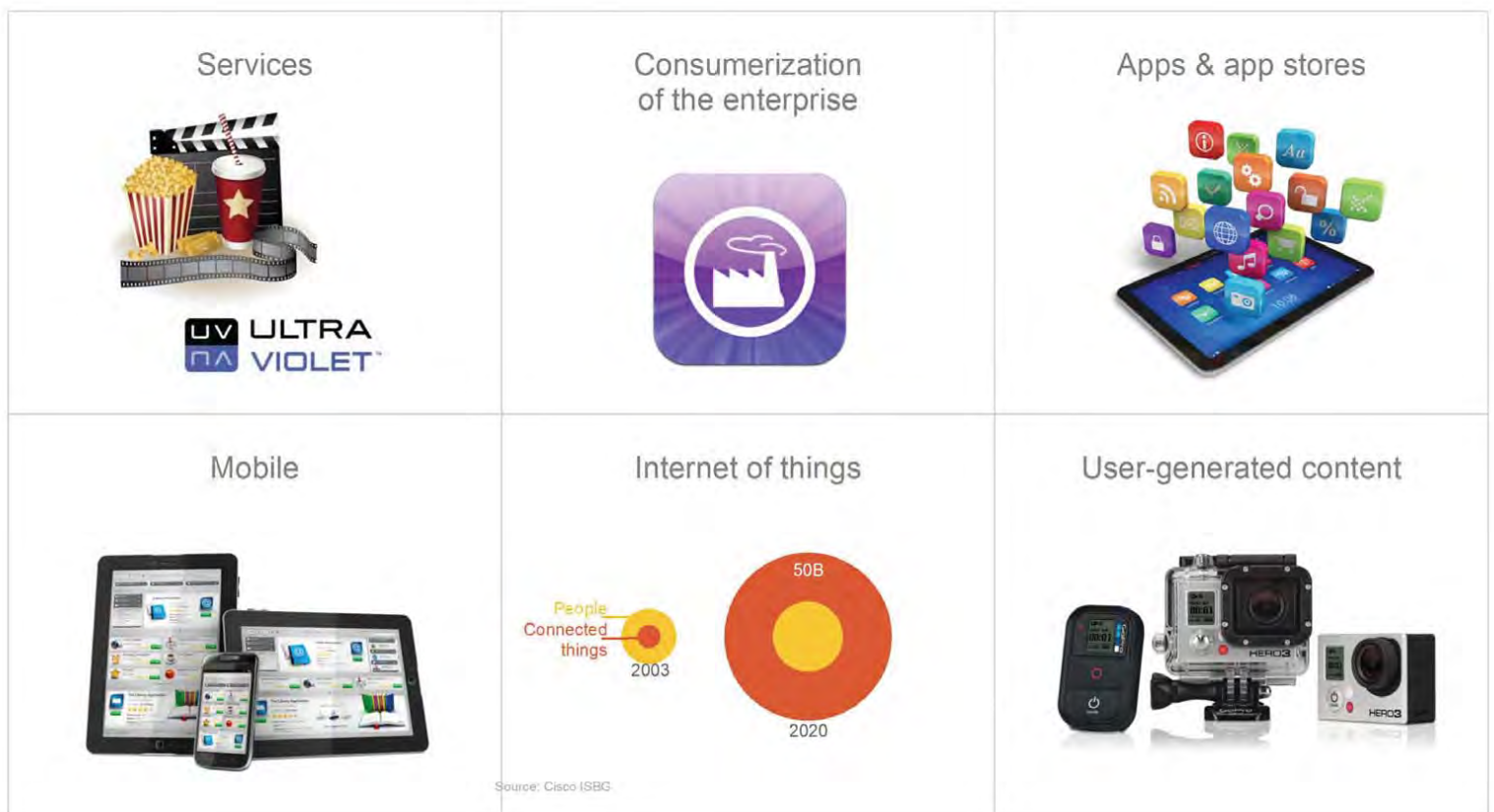


Market Overview & Product Update

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Tracking Industry Trends



Branded Product Sub-Segments

				
	Direct Attached Storage	Mobility	Simple Network Attached Storage	Business Storage
What is it?	External, removable	Wireless	Home NAS, cloud	Low-end NAS, cloud
How big is it globally?	\$5B	\$125M*	\$290M	\$814M
Growth rate (YOY)	5 to 10%	40 to 50%	20 to 30%	20 to 25%

The Americas Opportunity

-3.6%

Gartner estimates for PC shipment growth
between 2013 and 2014 (units)

Quarterly Statistics, Personal Computers, All Regions Forecast Database

4.8%

Seagate's estimates for external hard drive
shipment growth between 2013 and 2014 (units)

Seagate Market Research

20M unit, \$1.5B opportunity annually

26.3%

IDC estimates for tablet shipment growth
between 2013 and 2014 (units)

Worldwide Quarterly Tablet Tracker, Q12013

39.9%

Seagate's estimates for external hard drive *exabyte*
shipment growth between 2013 and 2014

Seagate Market Research

Exabyte Growth Over the Last 5 Years

Averages **37%** per Year

While Areal Density Is
Growing at **<20%** per Year

Looking Back at Fiscal 2013: Major Events



Seagate Slim

Just 3.5 months to develop despite CNY, Holidays, CES; shipped 36K in first 7 days



Dashboard "Fall"

Windows 8 compatibility, enhanced social media features, improved registration



Wireless Plus & Seagate Media

High-impact CES launch; product delivering composite VoC score of 4.0 out of 5



Seagate Central

CES Innovations Honoree, homerun review in major publication



Seagate Business Storage

Three major software releases; over 14K units in first two quarters after launch



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Simple Storage Product Philosophy

Customers are becoming increasingly connected.

Anytime, anywhere data access for consumption or backup becomes key.

PCs are shipping with faster storage...but less of it.

Performance expectations are increasing, but devices are getting 'thinner.'

Capacity is still important.

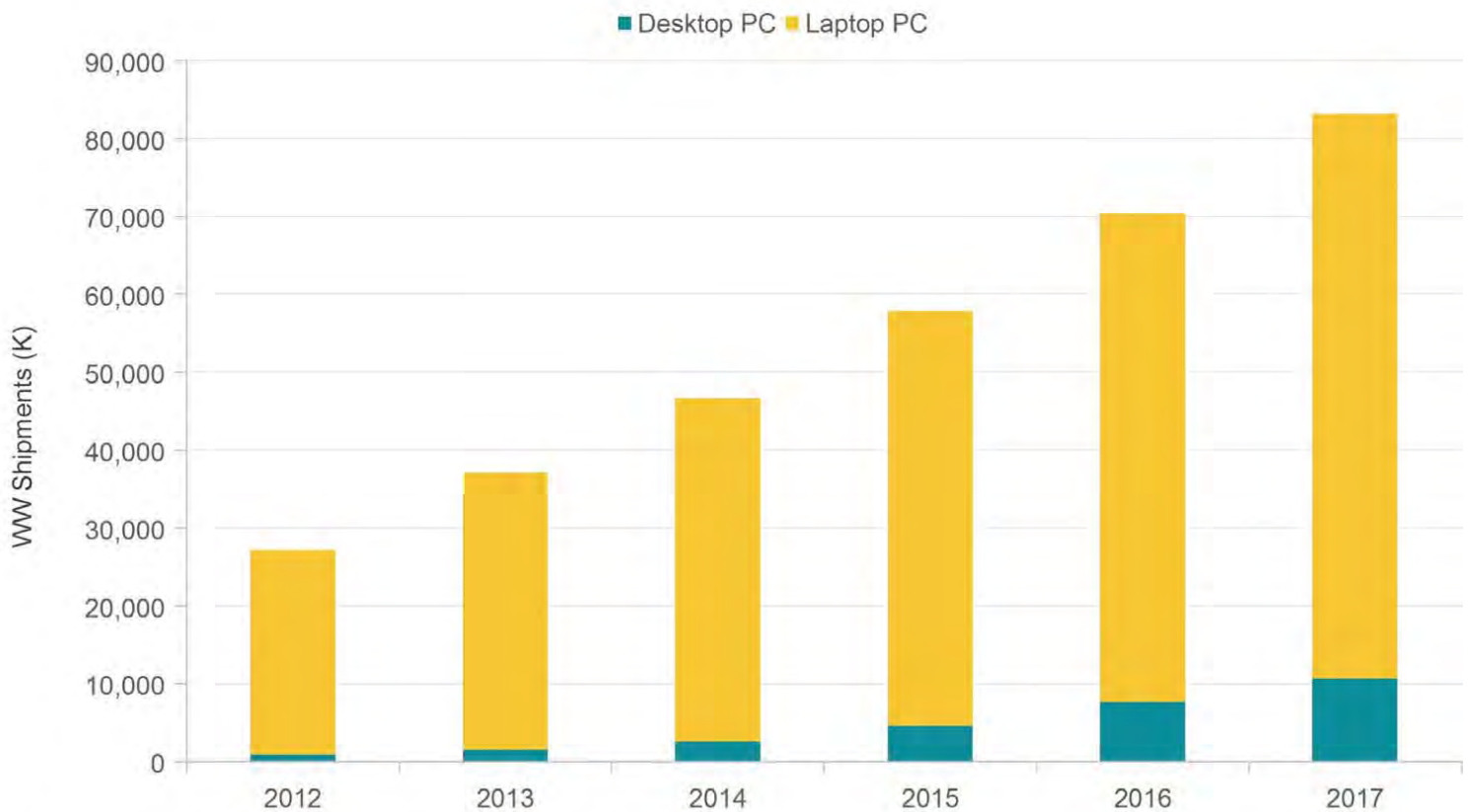
Content creation & acquisition is not slowing down and prices ar

Thin is in.

Laptops. Tablets. TVs. Phones.

PCs – Faster Performance...

SSD Shipments in Consumer PCs



Source: IDC, Worldwide Solid State Storage 2013 – 2017 Forecast and Analysis, May 2013.

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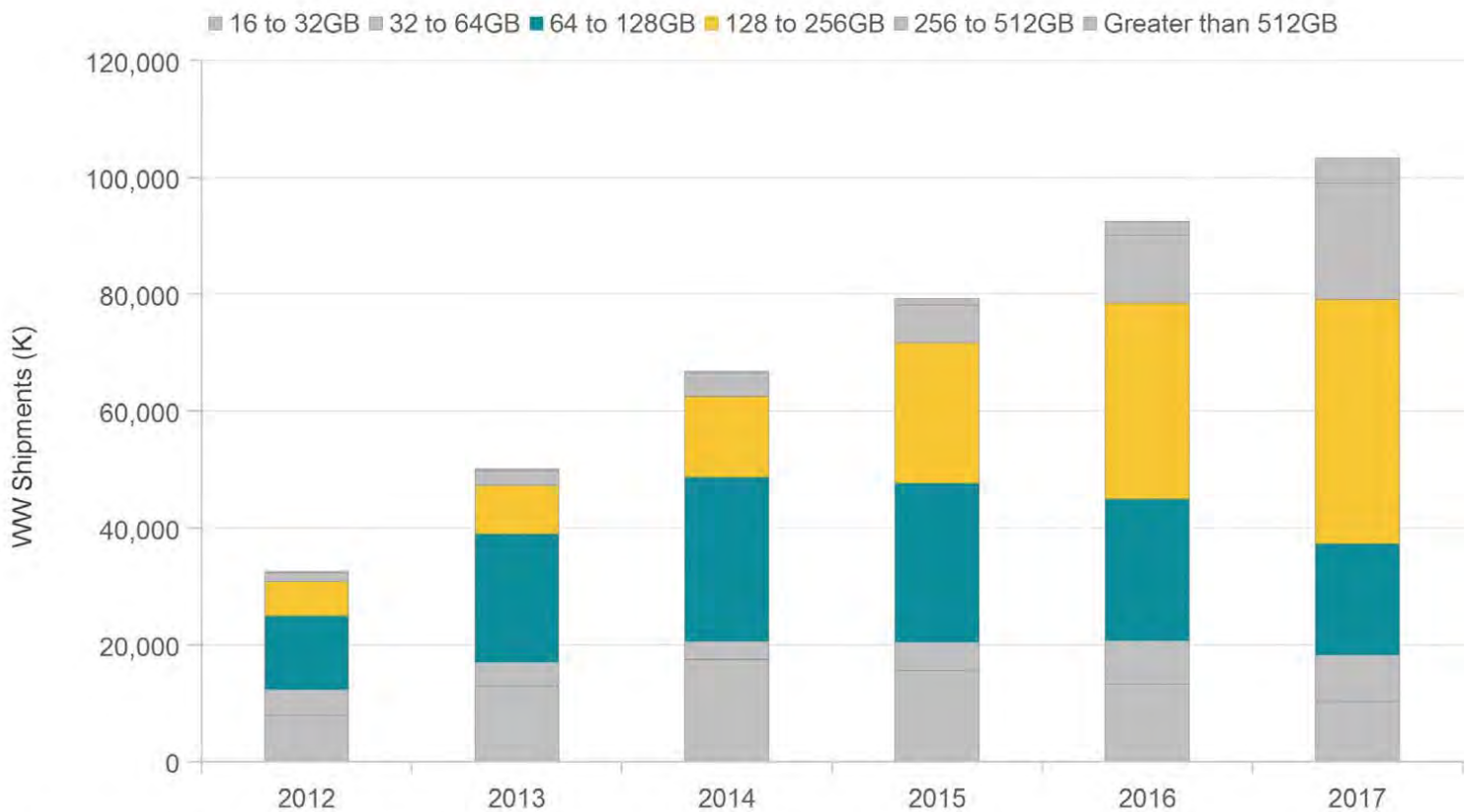
15

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PCs – Faster Performance...But Less Storage

SSD Shipments in Consumer PCs By Capacity



Source: IDC, Worldwide Solid State Storage 2013 – 2017 Forecast and Analysis, May 2013.

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Backup Plus Portable & Desktop Storage

Life moves fast. Don't miss a thing.

Simple-to-use, one-click backup software

The easiest way to protect your precious content

Automatically back up content from Facebook

Protect photos that you no longer have on your phone

Use with a Mac & PC...without reformatting

Install the included driver once to use across operating systems

Increase transfer speeds

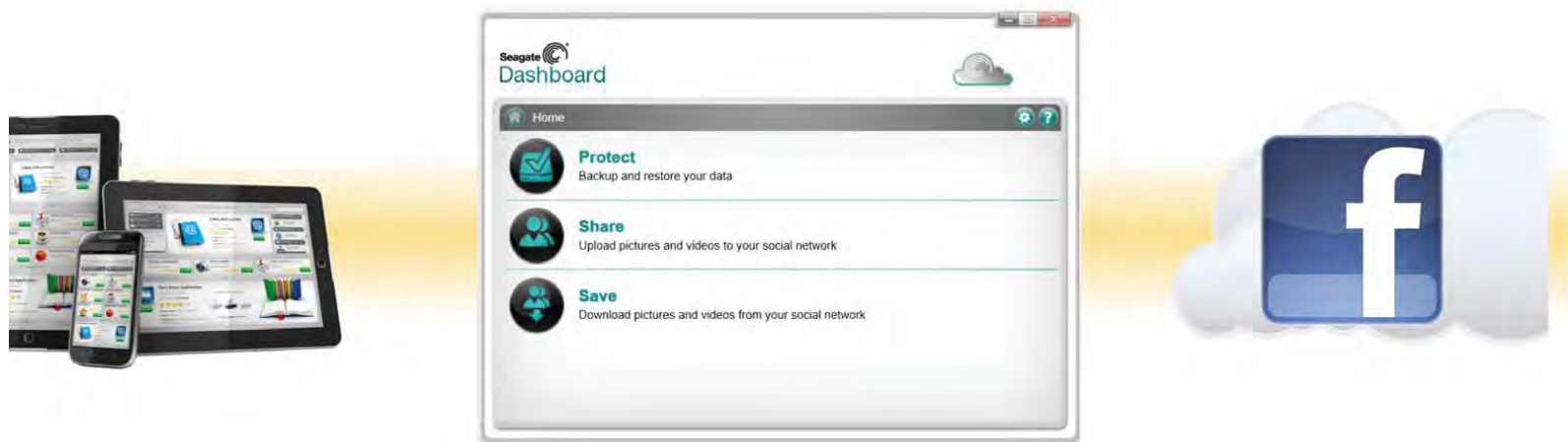
With Thunderbolt technology or FireWire to match the performance of your computer



Launches Q1CY14
Adds 2TB

Beyond Traditional Backup

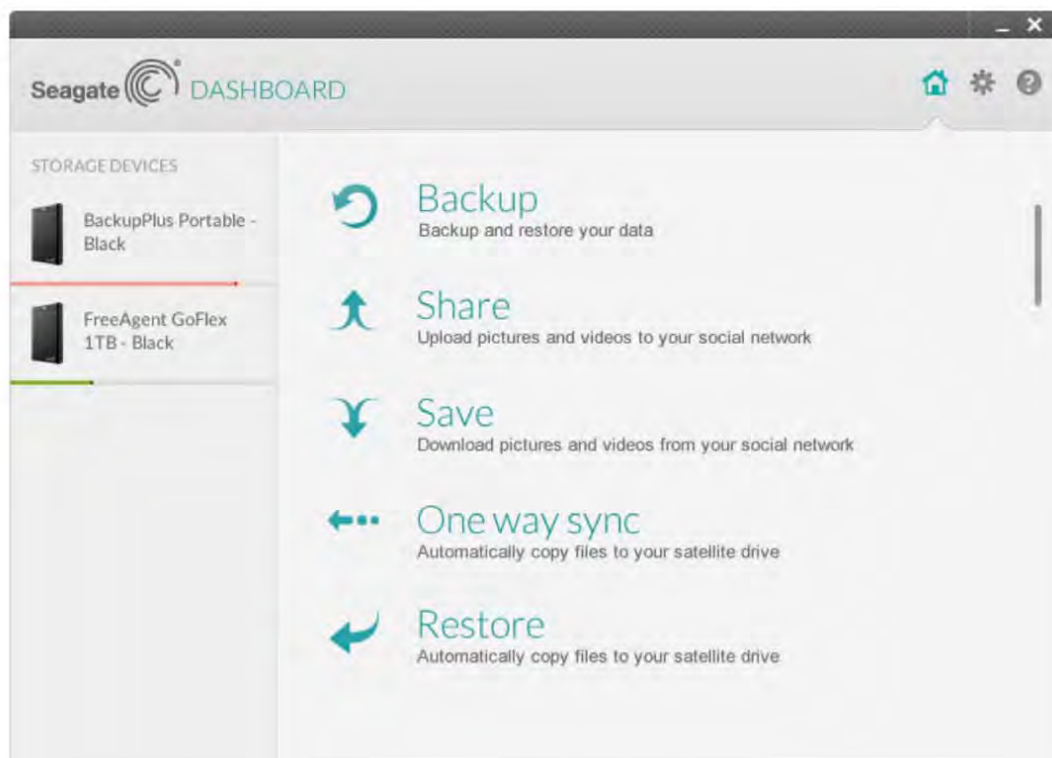
Delivering protection & content for the connected user



Innovating in traditional backup has diminishing returns;
new use cases involving connectivity will drive higher utility for users

Refreshed User Experience Design

Redesign or refresh?



Mobile Device Backup

Make more use out of your Dropbox account



From within the Dashboard, the user can enable mobile device setup and create credentials.



User is able to hit one button called "Backup" to send content to backup location. Credentials will need to be set up the first time.



Either remote or locally over Wi-Fi connection

Photos, v
all other
'accessib
content



Backup Plus

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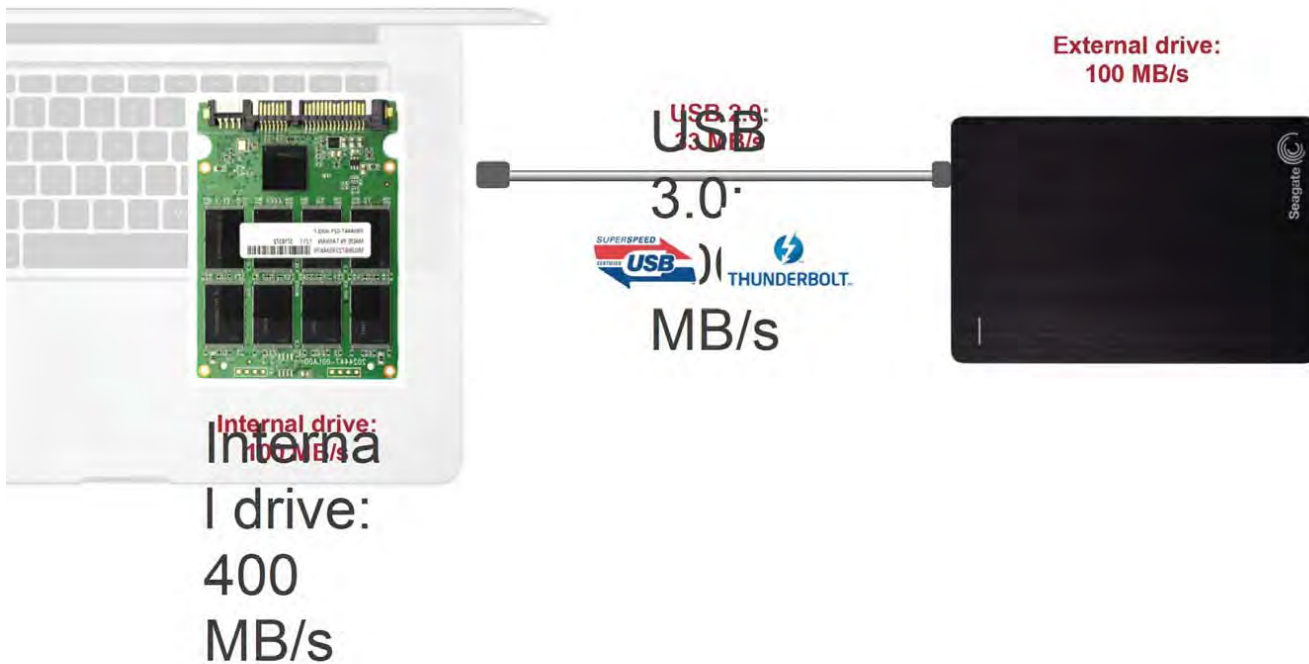
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Performance Matters

The bottleneck has shifted...



Seagate Fast HDD

World's first 4TB portable drive...with twice the performance

Capacity like no other

At least twice as large as any other portable drive

HDD performance like no other

220MB/s performance

Performance on the go

Less than 22-mm thick

No fussing with cables

Requires single USB cable for most PCs

MSRP: \$249.99

Available in Q4CY2013



Desktop SSHD

SSD Speed. HDD Capacity.

SSD performance

8GB MLC flash delivers +50% boot time performance
7200RPM

HDD capacity

3.5" 2TB & 4TB 15-mm configuration

Affordable price

2TB MSRP: \$164.99; MAP: \$134.99

4TB MSRP: \$274.99; MAP: \$224.99

3-year warranty

August 2013



Mobility Philosophy Slide

As the cloud is gradually adopted & content collection continues...

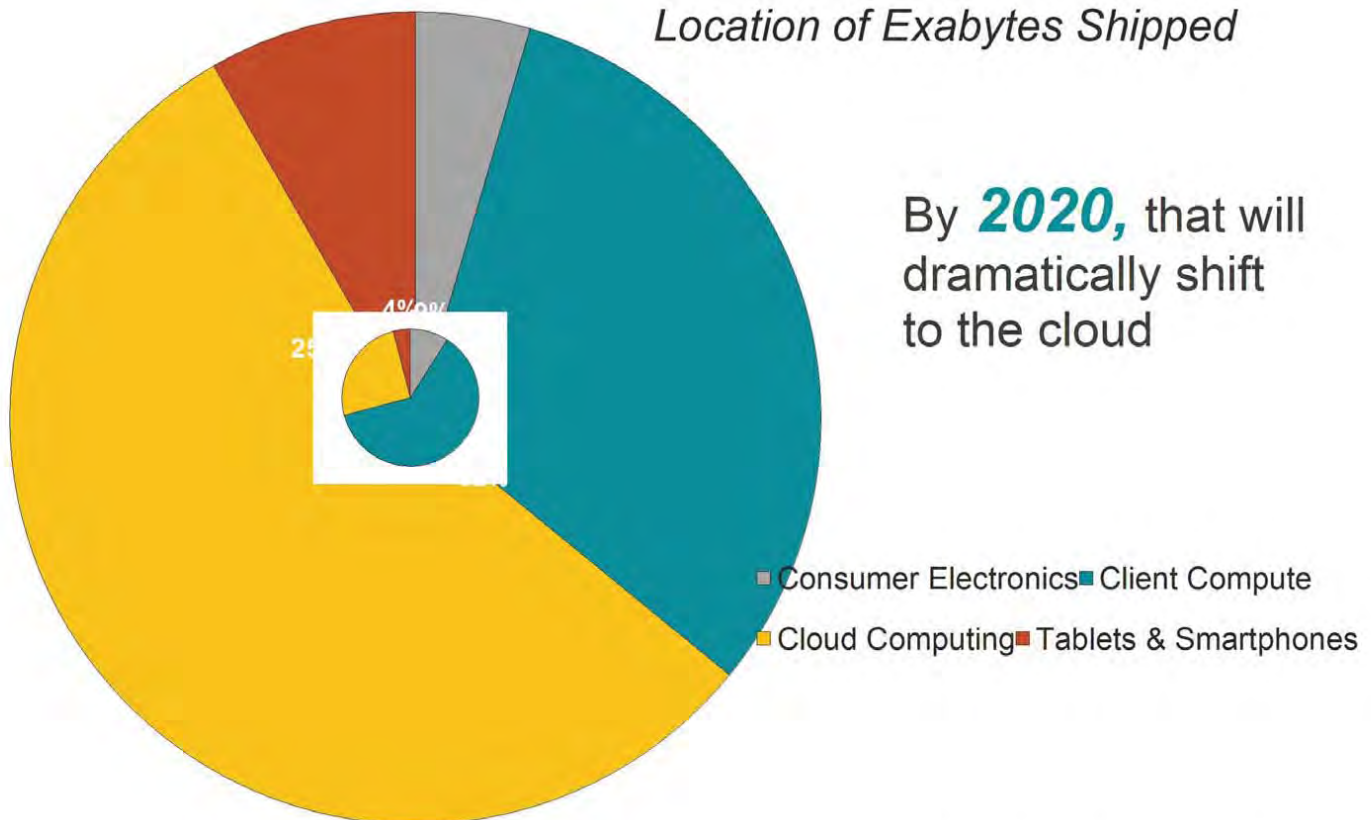
2014
Circa 2008



...there will be an increasing need for complimentary "edge" storage

This Move Toward Mobility Is Shifting the Location of the Data

Location of Exabytes Shipped

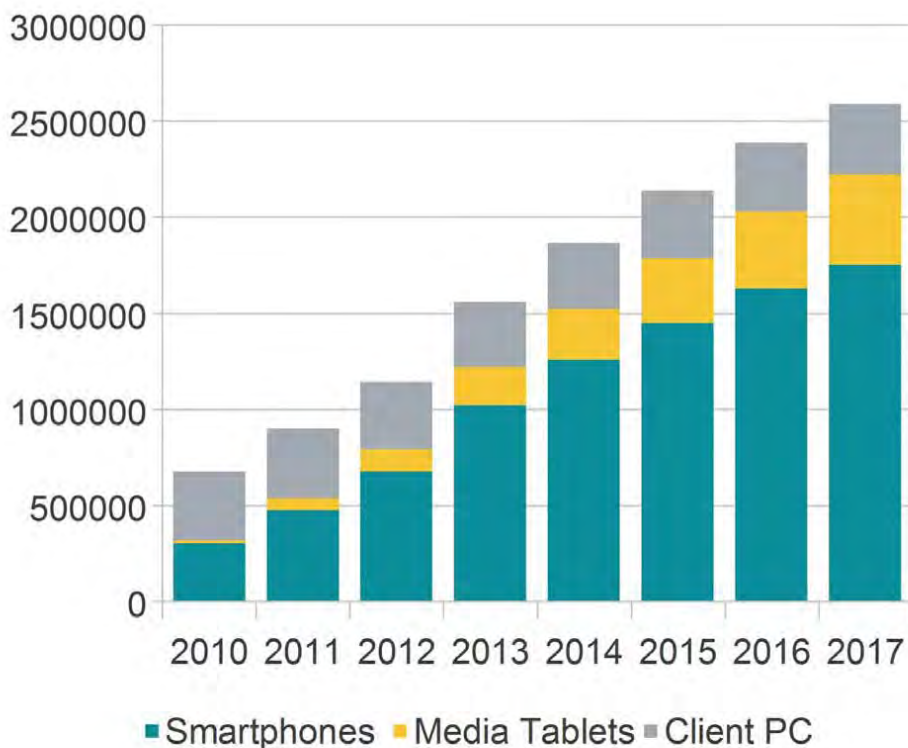


Source: Seagate Strategic Marketing and Research 2013

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FED_SEAG0012132

Mobility, Consumerization and the Cloud Change Where Compute Takes Place



By 2014,
eight of ten
compute devices
will be ***tablets*** and
smartphones

Seagate Wireless Plus

Mobile wireless storage for your tablet & smartphone. Take what's yours.

Improved out-of-box setup

"Five minutes to fun"

Enhanced media experience

Simplified, content-centric navigation

Stream to TV via Airplay, DLNA, or Samsung TV app

Upload content

Save pictures & files to drive while mobile

Appears as a network drive to a PC

Longer battery life

Targeting battery life of iPad 10 hours (+3-5 from Satellite)



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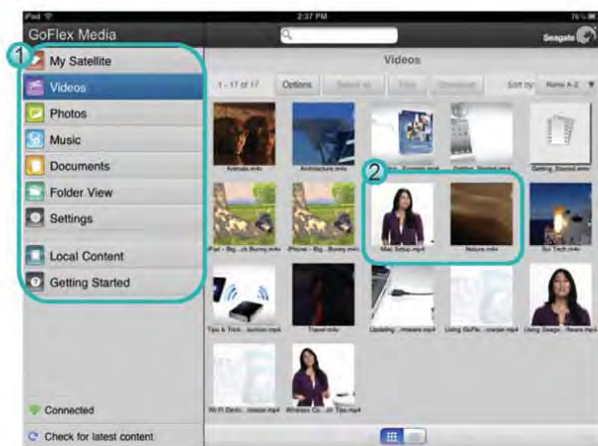
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FED_SEAG0012134

Application Improvements from Satellite

Version 2.0

Seagate GoFlex Satellite (Version 1.x)



Seagate Wireless Plus (Version 2.x)



Cleaner navigation. User has whole screen to view and navigate

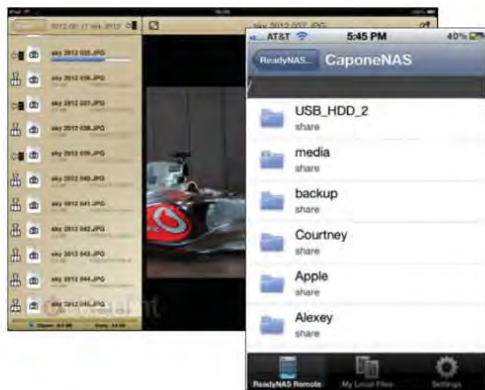
Improved layout. Movie aspect ratio & metadata

New status indicators. Battery indicator and data base status logically grouped

Seagate Media App

A different approach

Competitors – ‘Protect & store’
Remote file access



- Folder / file centric navigation
- Download only, no streaming

Seagate – Enjoy & access
Remote access & content consumption



- Content centric navigation
- Upload, download & streaming support
- Remote access to Home Share public folder

Single app across connected Seagate home products
Content-centric experience inside and outside of the home

Out-of-Box Improvements: 5 Minutes to Fun

Getting Started



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FED_SEAG0012137

Developing Apps to Exploit OS Features

Strives for consistent navigation and experience across platforms.

Exception - When interacting with key OS elements (such as player controls, and Wi-Fi setup) the app should look as native as possible to minimize user confusion.



Version 2.0 iOS



Seagate Media Win8 Concept

Win8 Opportunity. Utilize Metro centric design principles to enhance usability.

Consumer NAS Philosophy

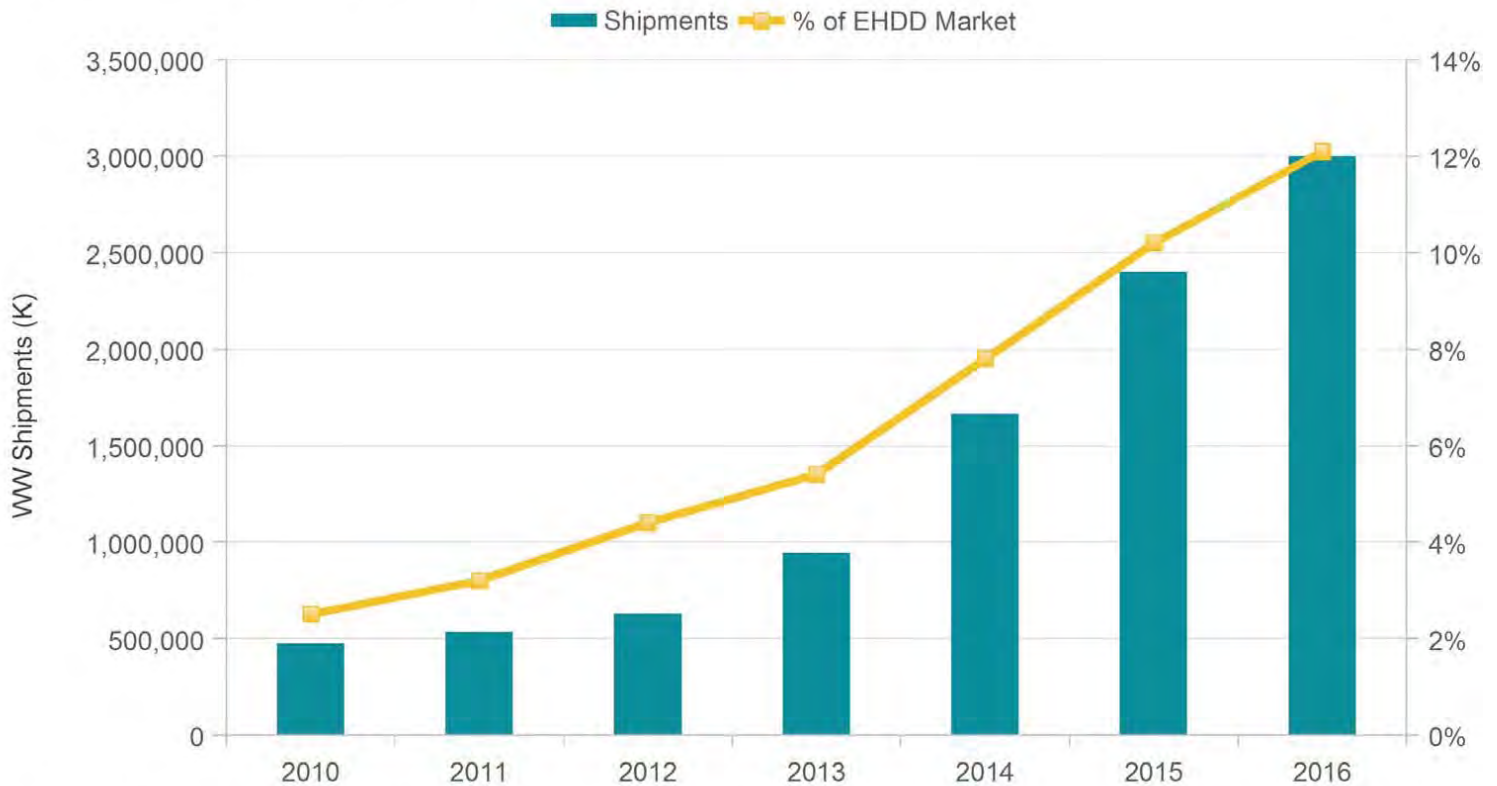
NAS was typically associated with computer backup...



...but the “Internet of Everything” phenomenon gives it life in the mobile & entertainment spaces

Consumer NAS Will Grow

Different from before, the number of connected devices will grow astronomically



Source: IDC, 3Q 2012 Personal & Entry Level Storage Device Forecast, December 2012.

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FED_SEAG0012140

Seagate Central

Automatic backup, organization and remote access to all of your files.

Automatic and continuous backup

For every computer in the home

Access and enjoy your media library and files

From gaming consoles, streaming media players or Smart TVs in your home

View and enjoy your media library and documents

On your tablet or smartphone with our free app for iPad, iPhone and Android device

Access, upload or download content remotely

Wherever you have a Wi-Fi or 3G/4G connection using the Seagate Media App or a web browser



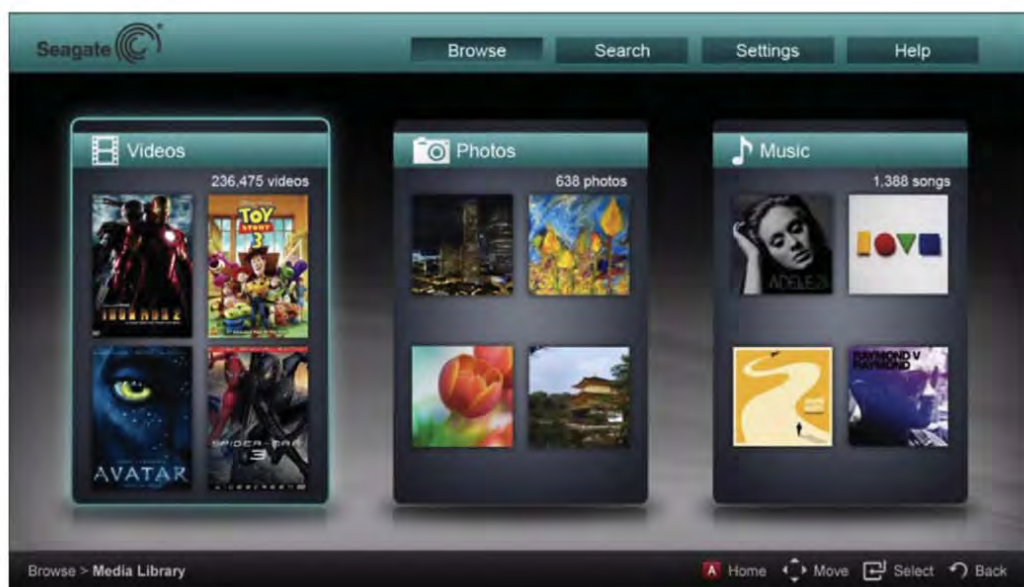
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FED_SEAG0012141

Samsung TV App



Seamlessly connects to Seagate Central & Wireless Plus
Easy to search, browse & play content from Seagate Home products

Summary

- The hard drive opportunity continues to grow, albeit fueled by growth in technologies that compete for dollars with traditional PC sales
- Innovation continues in the simple storage space, focusing on connectivity through software, performance and capacity
- Smartphone and tablet growth, along with the expectation of anytime, anywhere access to content will



Backup Slides

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FED_SEAG0012144

Seagate Products At-A-Glance June 2013

Connected



Central

Organize and back up all your content on one device that you can access from anywhere
Desktop: 2TB, 3TB, 4TB



Wireless Plus

Enjoy your content anywhere—without wires or web; wirelessly stream your media and files to tablets, smartphones, Mac® computers and PCs
Portable: 1TB



Mainstream



Backup Plus & Backup Plus Desk

Simple, one-click protection of your entire digital life; includes cloud, social media backup & cross platform capabilities

Desktop: 1TB, 2TB, 3TB, 4TB

Portable: 1TB



Backup Plus & Backup Plus Desk

Time Machine-ready right out of the box, use with Mac & PC without reformatting

Desktop: 2TB, 3TB, 4TB

Portable: 1TB



Slim

All the benefits of Backup Plus in an impossibly thin, lightweight package

Portable: 500GB



Slim for Mac

Time Machine-ready backup in an impossibly thin, lightweight package

Portable: 500GB



Entry Level



Expansion Portable & Desktop

Simple plug-and-play USB storage

Desktop: 1TB, 2TB, 3TB, 4TB

Portable: 500GB, 750GB, 1TB



Internal Kits

Easy upgrades for your existing computer, including SSD-like hybrid technology

Desk: 500GB, 1TB, 2TB, 3TB, 4TB

Desk SSHD (AUG): 2TB, 4TB

Portable: 250GB, 320GB, 500GB, 1TB

Portable SSHD: 500GB (JUL), 1TB

Not shown: Business Storage
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Seagate Business Storage

Collaborate anytime, anywhere.

Centralize

Centralize your storage for all your PC and Mac computers

- Automatic backup

Connect

Connect securely to your files with remote access using PC, Mac, tablets and smartphones

- Free app for iPhone, iPad and Android devices

Collaborate

Create and collaborate on your own private cloud

- Setup can be as little as 10 minutes



Seagate Fast SSD

External SSD – perfect match for SSD-based PCs

Performance to complement your high-end PC

Over 400MB/s performance

Compact, premium industrial design

Ultra-thin, metal top cover design

Great for being on the go

No mechanical, moving parts

Available in Q3CY2013

Capacities: 120GB, 240GB & 500GB



Seagate Confidential

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FED_SEAG0012147

Seagate 600 SSD

Performance, performance, performance

Delivers nearly 4X faster boot times & more than 2X faster application load times when compared to typical laptop HDDs

Ruggedness for when you're on the go

No mechanical, moving parts helps ensure data stays safe even if laptop is dropped or bumped while operating

Designed to fit the latest laptops

Fits 7- or 9.5-mm based laptops with included adapter

Available in Q4CY2013

Capacities: 240GB



EXHIBIT 41



Marketing Bulletin

Barracuda® Hard Drives— Update and Outlook

Frequently Asked Questions

What's happening with the Barracuda Green drive?

Seagate plans to discontinue the Barracuda Green drive in early calendar year 2012. Seagate OEM and distribution channel customers have made clear their need for a simpler, more efficient hard drive platform for desktop computing that helps improve their operational efficiency while meeting all the fundamental needs of storage performance, reliability, capacity and affordability.

Isn't there a need for low-power hard drives in the marketplace?

In the consumer electronics market, low-power hard drives coupled with other key customer needs, such as tuned video performance and quiet acoustics, are still needed. Seagate will continue to support this market with its Pipeline HD® product line. However, for desktop storage applications, power consumption is more efficiently managed through power modes, such as sleep, standby and hibernate.

When combined with the typical power-on hours for most desktop computing applications, a low-power drive will save only US\$0.09 to US\$0.21 in electricity cost annually.¹ This comes at the expense of user productivity, supply chain efficiencies and qualification costs for suppliers. Combined, these factors offset the minimal power savings many times over.

What about the Barracuda XT drive?

The Seagate Barracuda XT drive will continue to represent our top performance desktop products. In the short term, the new Barracuda product line overlaps the Barracuda XT drive at the 3TB capacity point.

In the near future, Seagate has plans to extend the role of the Barracuda XT drive with new capacity points and, ultimately, the Barracuda XT drive will transition to solid state hybrid drive technology for desktop storage.

1. U.S. Department of Labor reported an average annual electricity cost of \$0.10 per kWh. Power on hours ranging from 100 to 200 hours. Calculations correlate a 750W ATA 7.0 and 3TB Barracuda XT drive with a 500W ATA 6.0 and 3TB Barracuda XT drive.

Barracuda® Hard Drives— Update and Outlook



Frequently Asked Questions

Why is the hard drive industry moving to Advanced Format 4K sector technology?

Driving growth in capacity and storage efficiency requires the deployment of a number of technologies. The entire hard drive industry will eventually be deploying larger sectors, as the legacy 512-byte sector format limits hard drive capacity growth.

Seagate is deploying Advanced Format in conjunction with Seagate SmartAlign™ technology to make this transition virtually invisible to most customers. Our goal is to continue to offer differentiated products with solutions that will make this type of technology transition as easy as possible.

What is Seagate AcuTrac™ technology?

Seagate AcuTrac technology is the name for new advanced servo technology that enables track densities never before deployed in the hard drive industry. Barracuda drive 1TB/disk technology is enabled with track densities equal to 340,000 tracks in every radial inch. This means a hard drive track is a mere 75 nanometers wide. Even so, AcuTrac technology can accurately and reliably read and write data to these *nano-sized* tracks spinning at 7200 revolutions per minute. The technology is resilient in the most challenging operating environments. For example, AcuTrac technology is effective at compensating for operating vibrations, which can normally occur when installed in an all-in-one PC and used in conjunction with loud music being played through an integrated speaker set.

What is Seagate OptiCache™ technology?

Seagate OptiCache technology is the name for a collection of new hard drive technologies that together help optimize overall speed and burst performance such as caching. These technologies include new 40nm microprocessor technology with improved speeds and low power consumption, DDR2 faster DRAM deployment, new and improved caching algorithms, and, of course, fast SATA 6Gb/s interface technology. Together these improvements deliver performance that is up to 69% faster² than previous-generation Barracuda drives.

When will hybrid technology be available for desktop storage?

Although Seagate has no announcement at this time with respect to when hybrid drive technology will be deployed for 3.5-inch hard drives in the desktop market, we continue to invest in this technology and expect to offer compelling high-performance products in this category in the future.

When will current-generation Barracuda products go end of life?

Current-generation Barracuda products are based on 500GB-per-disk technology. This generation products will remain available in 250GB, 320GB and 500GB capacities. The only significant change is that these products have also adopted Advanced Format 4K sector technology and now include Seagate SmartAlign technology.

Products over 500GB will utilize the new 1TB-per-disk technology.

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Barracuda® Hard Drives— Update and Outlook



Frequently Asked Questions

How can I make sure I'm ordering the new 1TB/disk Barracuda products?

Any product ordered with a capacity over 500GB will include the Seagate 1TB-per-disk technology.

Barracuda hard drives are adopting the new ST model number format, shown in the following table:

ST Model	Capacity	OptiCache™	AcuTrac™	SmartAlign™
ST3000DM001	3TB	Yes	Yes	Yes
ST2000DM001	2TB	Yes	Yes	Yes
ST1500DM001	1.5TB	Yes	Yes	Yes
ST1000DM003	1TB	Yes	Yes	Yes
ST7500DM003	750GB	Yes	Yes	Yes
ST500DM002	500GB	No	No	Yes
ST3200DM000	320GB	No	No	Yes
ST2500DM000	250GB	No	No	Yes

Why is the warranty on Barracuda drives changing to two years?

Barracuda hard drive warranties now reflect a modified two-year limited warranty, which includes a higher credit for the two-year time period. This change was made to reflect a marketplace in which the solutions that integrate hard drive products typically carry warranties of only one year. Suppliers and customers increasingly place lower value on a longer warranty.

www.seagate.com

AMERICAS: Seagate Technology LLC, 10200 South De Anza Boulevard, Cupertino, California 95014, United States; 408-858-1000
ASIA/PACIFIC: Seagate Singapore International Headquarters Pte. Ltd., 7000 Ang Mo Kio Avenue 5, Singapore 569577; 65-6485-3888
EUROPE, MIDDLE EAST AND AFRICA: Seagate Technology SAS, 16-18 rue du Dôme, 92100 Boulogne-Billancourt, France; 33-1-4156 10 00

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EXHIBIT 42

From: Joni J Clark <joni.j.clark@seagate.com>
Sent: Monday, July 20, 2015 8:55 AM
To: Kim O Nguyen <kim.o.nguyen@seagate.com>
Cc: Brent Blanchard <brent.blanchard@seagate.com>; Aubrey Muhlach <aubrey.muhlach@seagate.com>; Sarah Good <sarah.good@seagate.com>; Erin Sun <erin.sun@seagate.com>; Jennifer L Bradfield <jennifer.l.bradfield@seagate.com>
Subject: Re: Synology Meeting- Backgrounder
Attach: Pick The Right Drive For The Job — 24_7 NAS HDDs vs. Desktop HDDs _StorageReview.com - Storage Reviews (1).pdf; Paper-for-CIO-Review Approved (1).docx; Seagate - Reliability - anchor article v4.4 - no highlighting.pdf

Hi all-

Attached are three articles that will be published in well known online trades: Storage Review, Tom's Hardware and CIO Magazine. 2 of them go live today or tomorrow with the third following up shortly. Storage Review is 99% done and I've pre-read the article below and "suggested" some minor changes.

In addition, we are developing infographics, videos (see draft of video link), tech briefs, blogs, and webinars both with Synology and without on Reliability, High Cap upsell and Choosing the right drive for the job. All in various phases of development but all rolling out weekly this quarter and next.

<https://drive.google.com/file/d/0B-ubfVW2W7yeaThaYmtGMWwzXzA/view?usp=sharing>

I do plan to update Synology with the work STX is doing with and without their involvement. In fact, since we've been attending some of their reseller events I continue to get emails such as these from Synology's resellers about our "Why not give Seagate a try?" program...

*"Hi Joni,
 it was a pleasure meeting you at the conference in NY, albeit the short conversation. Your demonstration was very helpful and gave me some great insight.*

"
Ping Kuo, Senior Lead Engineer, Techasaurus

"Thanks for making this available – I'm really looking forward to spending some quality time with this system (NAS HDD) to put it through its paces."
Ron Rosen, Tech Advisor

"I look forward to testing out the new drives in the Synology NAS solutions."
Jeffrey Feltman, Infrastructure Practice Lead, JCS Solutions

Thanks,

Joni

Joni Clark | Seagate Technology
Global NAS Segment Manager
720-684-1145 | joni.j.clark@seagate.com

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On Mon, Jul 20, 2015 at 9:22 AM, Kim O Nguyen <kim.o.nguyen@seagate.com> wrote;

Hi Brent,

Yes, Joni will be in the meeting and will have updates for us on both pieces. The Tom's HW article is ready to go, but our PR decided to hold off due to the Apple recall on the 3TB. We are awaiting the release of the Storage Review article first, and Synology has been working with them on that.

Joni- any updates on actual release dates?

We do have a good understanding of their complaints and they are valid. In promoting the partnership with us early on, they were getting negative feedback from the media, customers, resellers and disty- all asking why they weren't partnering with WD Red and pointing out our poor reliability based on the Backblaze article. They said we did not do a good job differentiating ourselves from WD, defending our reliability, and educating the customer on the differences between desktop vs. NAS (so when they pointed out that that Backblaze article was for desktop NOT NAS, customers didn't know or understand the difference). They felt the partnership was hurting their sales and efforts. Joni worked closely with them to put together a plan to address their concerns and the 2 articles are a key piece.

Regarding the exclusivity-

This BeyondCloud project is the first time that Synology has integrated drives; everything else ships empty. We agreed to meet their price targets for drive purchases in exchange for an agreement to co-market only with Seagate, and use only Seagate drives for any BeyondCloud systems. Synology had a similar agreement (co-marketing only, no drive purchases) with WD for 2 years prior to our agreement. Attached is a copy for your review. This agreement expires July 31, 2015.

Let me know if you have any other questions.

Look forward to meeting you on Thursday!

Kim Nguyen
Seagate Technology
Office: [310.881.9632](tel:310.881.9632)
Mobile: [773.230.6903](tel:773.230.6903)

On Sun, Jul 19, 2015 at 1:43 PM, Brent Blanchard <brent.blanchard@seagate.com> wrote:

Thank you Kim. Will we have an update from Storage Review and Tom's HW before the meeting? Do we have a good understanding of the customer complaints and are they valid?
also, Can you send me details on the exclusivity deal? who does Synology buy from?

thanks
bb

On Fri, Jul 17, 2015 at 8:56 AM, Kim O Nguyen <kim.o.nguyen@seagate.com> wrote:

Hi All,
Please see attached for Synology backgrounder for the meeting on Thursday, July 23rd. Let me know if you have any questions.

Thanks,

Kim Nguyen
Seagate Technology
Office: [310.881.9632](tel:310.881.9632)
Mobile: [773.230.6903](tel:773.230.6903)

or Microsoft Global Channel sales

Seagate Technology | 10200 S. De Anza Blvd. | Cupertino, CA 95014 | [408.896.6775](tel:408.896.6775)

EXHIBIT 43

From: Pam Dake <pam.dake@seagate.com>
Sent: Friday, March 23, 2012 11:43 AM
To: jennifer.l.bradfield@seagate.com; Gregory J Falgiano <gregory.j.falgiano@seagate.com>; Connie Wai <connie.wai@seagate.com>; Astonna McCoy <astonna.l.mccoy@seagate.com>; Leo Paskin <leo.paskin@seagate.com>; Jackie P Iverson <jackie.p.iverson@seagate.com>; Kathleen Noce <Kathleen.Noce@seagate.com>; David J Rewalt <david.j.rewalt@seagate.com>
Subject: Product Training Follow-up
Attach: Product Overview - NAS - Seagate GoFlex Home Overview.pptx; Customer-Ready Presentation Template_1-17-12.ppt; Sales Training Template_1-17-12.ppt; Challenger Model Product Training Materials_3-22-2012.xls

Hi Jen, Greg, Connie, Astonna, Leo, Jackie, Kathleen, and David,
 Thank you very much for inviting me to your team meeting yesterday. It's always extremely insightful for me to hear about your team's processes and challenges. With this added information, I can see how I can be of better assistance to you as your Sales Enablement training partner.

GoFlex Home Presentation

I reviewed the GoFlex Home presentation and think that there is really great information included that is very easy to follow and consume as a learner. I realize that the details displayed in the GoFlex Home presentation are needed for a certain number of sales people, and I understand that this type of presentation still needs to be put together for those deeper-dive web-ex training sessions. However, in the spirit of consistency and brevity for Sales people who do not need all of the details, I recommend using the attached templates for Sales Training and Customer-Ready presentations for new product launches. For the overall sales teams, the value they will receive in having access to a shorter more "templated" presentation (that also includes Challenger Model Industry set-up information following the "TIPS" structure upfront) can be tremendous--- more Sales people learning about your products and talking to their customers about them---even if they don't ordinarily sell branded products.

The Good News

The information needed for the 8-slide Sales Training presentation and the 10-slide Customer-Ready presentation is already 85% covered by what is included in the GoFlex Home presentation. What is not currently included is the Challenger Model set-up and the TIPS structure. What will set our Sales teams apart from other companies' sales teams is in how they "Teach for Differentiation", by leading with insightful irrefutable facts, and bring the conversation with customers around to our products, not lead with them. Sales teams are really hungry for our Marketing materials to follow the Challenger Model structure (especially since their personal iMAP goals are tied to how they exhibit Challenger behaviors with their customers!)

The Goal

For the WWSM, we are considering a different approach to providing product information to Sales. This format would require all current products have a Battlecard and templated Customer-Ready presentation available.

Help is Available

If you are looking for ideas on what information to use to incorporate Challenger Model insights in "Teaching for Differentiation", I recommend starting with the available Point of View (POV) documents Jeff Burke's team has put together. You can also find the latest Industry information/trends under the "Market Insights" tab of [SalesCenter](#). In addition, I am available to help!

Recommended Next Steps

- If you haven't uploaded your Battlecard(s) to Conversation Coach, I would do that first.
- Look at the attached Customer-Ready presentation template and let me know how long it will take for you to have each of your products in this format. Is **May 1** a reasonable deadline?
- Use the Customer-Ready presentation template for each of your products and send to me by **May 1**.

Follow-up

I am currently looking into our Brainshark capabilities as we talked about for new product launches. (For your reference, I have attached the "Challenger Model Product Training Materials" Excel file that highlights Brainsharks as a vehicle for delivering the Sales Training presentations.) The great news with short 5-10 minute Brainshark trainings is that they can be individually tracked in iMAP and "required" for Sales people to review. I will follow up with a separate email when I have answers.

Thank You!

I really appreciate the opportunity to work with each of you on product training on an ongoing basis.

Best regards,
Pam

--

Pam Dake | Sales and Partner Training Manager | Seagate Technology

10200 S. De Anza Blvd Cupertino, California 95014 | 408-658-1735

EXHIBIT 44

Subject: Re: Another article from Backblaze on empirical HDD reliability data in their systems
From: Jason P Zimmerman <jason.p.zimmerman@seagate.com>
To: John D Grieci <john.d.grieci@seagate.com>
Cc: Ronald E Lane <ronald.e.lane@seagate.com>, Sai S Varanasi <sai.s.varanasi@seagate.com>, Matthew Brown <Matthew.C.Brown@seagate.com>, "Joel. Hagberg" <joel.hagberg@seagate.com>, Alan W Clark <alan.w.clark@seagate.com>, Debasis Baral <debasis.baral@seagate.com>, Michael J Frahill <michael.j.frahill@seagate.com>, Mark E Wojtasiak <mark.e.wojtasiak@seagate.com>

Just to make sure you all saw this today...still may not be a bad idea for us to use them as a sounding board, but this article debunks the whole article and conclusion...

<http://www.tweaktown.com/articles/6028/dispelling-backblaze-s-hdd-reliability-myth-the-real-story-covered/index.html>

Thanks, tweaktown!

On Jan 22, 2014 9:17 PM, "John D Grieci" <john.d.grieci@seagate.com> wrote:

Sai,

That would be very helpful, thanks.

John

On Thu, Jan 23, 2014 at 10:40 AM, Sai S Varanasi <sai.s.varanasi@seagate.com> wrote:

John,
We should meet these guys.
We will prepare a list of questions.

Regards,
Sai

US # 303 913 9309
Singapore # 065 86984220

On Jan 23, 2014 9:43 AM, "John D Grieci" <john.d.grieci@seagate.com> wrote:

Sai,

Please help with this as much as you can. We need to get to the bottom of it.
What if WE go meet with these guys?

John

On Thu, Jan 23, 2014 at 8:58 AM, Sai S Varanasi <sai.s.varanasi@seagate.com> wrote:

This is very confusing. Such high rates dont make sense.
We also need to understand how they are testing as well.
Is this company funded by WD ?

Mick,
I am guessing you will setup a call ?

Sai

Thanks
Sai
Singapore # (65) 86984220
US# (01) 303 913 9309

CEE.SEAGATE.COM

On Thu, Jan 23, 2014 at 8:48 AM, Michael J Frahill
<michael.j.frahill@seagate.com> wrote:

Hi John,
Please see list of all Seagate drive types mentioned in the article below.

Model Number	Drive Name	Segment	Capacity	Qty	Avg Age in Years	Annual Failure Rate
ST4000DM000	Lombard	Desktop	4.0TB	5199	0.3	3.80%
ST3000DM000	Grenada	Desktop	3.0TB	4252	1.4	9.80%
ST31500541A	Hepburn	Consumer	1.5TB	1929	3.8	9.90%
ST31500341A	Brinks		1.5TB	539	3.8	25.40%
ST33000651A	Mantaray	Nearline	3.0TB	293	2	7.30%
ST32000542A	Hepburn	Consumer	2.0TB	288	2	7.20%
ST4000DX000	Megalodon	Nearline	4.0TB	179	0.7	n/a
ST1500DL000	Bogart		1.5TB	51	0.8	120.00%

Thanks,

Mick

On Wed, Jan 22, 2014 at 4:22 PM, John D Grieci
<john.d.grieci@seagate.com> wrote:

Guys,

Can I please get a list of all Seagate drive types mentioned in the article so I have a good picture of that? Also same for Wdc and HGST drives?
Are they comparing BC with DT for instance?

John

> On Jan 23, 2014, at 12:52 AM, Ronald E Lane
<ronald.e.lane@seagate.com> wrote:

>
> Well, that would explain how they got all the Brinks drives....
>
> Matt/Alan - from a warranty standpoint, wouldn't we know when warranty was
> requested that these drives were originally sold as part of a retail
> product? Wouldn't think that they could get a bare drive replacement for
> these....

>
>
> Thanks,
> Ron

>
>
>
> On Wed, Jan 22, 2014 at 8:36 AM, Michael J Frahill <
> michael.j.frahill@seagate.com> wrote:

>
>> Hi Ron/Sai,
>>
>> Yes, that is correct.
>>
>> - They requested people to buy Seagate backup plus drives from Costco
>> and ship them to Backblaze, so that they could use them in their data
>> center. Search for 'Black Friday Drive Farmers' in this link
>> <http://blog.backblaze.com/?s=Seagate>
>>
>> [image: Inline image 2]

>>
>>
>> - If you continue reading the link, it sounds like this was not a
>> one-time deal and they continued to use this *strategy* to
source hard
>> drives - see below.
>>
>> [image: Inline image 1]
>>
>>
>> I'll call Jason to ensure we are on the same page.
>>
>> Thanks,
>>
>> Mick
>>
>>
>>
>> On Wed, Jan 22, 2014 at 5:19 AM, Ronald E Lane
<ronald.e.lane@seagate.com>wrote:
>>
>>> Sai,
>>>
>>> Mick has already started looking into this, so have Jason work
with
>>> Mick. If I read the last note from Mick correctly, this
company is
>>> scavenging drives from Backup Plus boxes to use in Cloud
storage
>>> applications.
>>>
>>> Ron
>>>
>>>
>>> On Tue, Jan 21, 2014 at 11:49 PM, Sai S Varanasi <
>>> sai.s.varanasi@seagate.com> wrote:
>>>
>>>> John
>>>> If you already have someone looking into this let us know.
Otherwise
>>>> Debasis and Jason will investigate.
>>>>
>>>> Regards,
>>>> Sai
>>>>

>>>> US # 303 913 9309
 >>>> Singapore # 065 86984220
 >>>> ----- Forwarded message -----
 >>>> From: "Sai S Varanasi" <sai.s.varanasi@seagate.com>
 >>>> Date: Jan 22, 2014 2:54 PM
 >>>> Subject: Re: Another article from Backblaze on empirical
 HDD reliability
 >>>> data in their systems
 >>>> To: "Mr. Arun Balakrishnan"
 <arun.balakrishnan@seagate.com>
 >>>> Cc: "Glen D Almgren" <glen.d.almgren@seagate.com>,
 "Chu Son" <
 chu.c.son@seagate.com>, "Dr. Serge Fayeulle" <
 serge.j.fayeulle@seagate.com>, "Hari H Narayan" <
 hari.h.narayan@seagate.com>, "Rich L Segar"
 <rich.l.segar@seagate.com>,
 >>>> "KeeAnn Chan" <kecann.chan@seagate.com>, "Sai V" <
 catalin.i.serpe@seagate.com>, "Jason P Zimmerman" <
 jason.p.zimmerman@seagate.com>, "Debasis Baral" <
 debasis.baral@seagate.com>, "Mr. Steven Crochiere" <
 steven.m.crochiere@seagate.com>
 >>>>
 >>>> Isn't the same company and same set of drives? Or does this
 include new
 >>>>> data.
 >>>>>
 >>>>> Debasis and Jason
 >>>>> Can you dig into this report and reasons for why our
 product could be
 >>>>> bad?
 >>>>>
 >>>>> Regards,
 >>>>> Sai
 >>>>>
 >>>>> US # 303 913 9309
 >>>>> Singapore # 065 86984220
 >>>>> On Jan 22, 2014 8:58 AM, "Arun Balakrishnan" <
 arun.balakrishnan@seagate.com> wrote:
 >>>>>
 >>>>>
 >>>>>
 >>>>>> <http://www.techspot.com/news/55399-backblaze-data-shows-hitachi-and-seagate-as-most-and-least-reliable-hard-drives-respectively.html>
 >>
 >>

>> --
>> Michael Frahill
>> Seagate Technology
>> Sr. Manager Customer Technical Support
>> michael.j.frahill@seagate.com
>> (o) 408-658-1025
>> (c) 208-860-5736
> <image.png>
> <image.png>

--
Michael Frahill
Seagate Technology
Sr. Manager Customer Technical Support
michael.j.frahill@seagate.com
(o) 408-658-1025
(c) 208-860-5736

--
John D. Grieci
Senior Vice President, Customer Advocacy
Seagate Technology
Cupertino, California

john.d.grieci@seagate.com
O 408-658-1166
M 508-254-4174

--
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M 508-254-4174

EXHIBIT 46

Alan Clark's Weekly Status Report - 1Q13

FW14

Week of 1-Oct-12 to 5-Oct-12

Highlights and Status (A.Clark):

- Continuing to work with the branded team to assess risk and next steps around our 3 and 4TB PS issue. We've narrowed the scope to one power supply vendor and now working to assess field exposure
- Participated with the Alpha test team for whitney, finally we have a code set that is functional enough to commence the Alpha bug hunt.
- Continue to work with the leadership and QA teams to resolve the teamwork issues. QA team will also manage a program to redesign the QA assessment methodology, based on excellent input from the CCC.

Business Analytics & Applications (T. Beaty):

- Knowledge Management : Waiting on updated SOW and Quote from Salesforce in order to initiate PR.
- Salesforce Service Cloud contract (CRM, KM, Chat & R6) was renewed for a 3 yr term. We will be working with Salesforce this next week on Chat implementation schedule.
- Salesforce Radian6 Social Media & Social Hub contact was signed for a 3 yr term. Radian6 will be in OKC on Oct 15-16 for implementation and "train-the-trainer".
- The following NDAs are in process with legal: OKC Food Bank, SIRAS, Centerbridge & Clarabridge.

Global SeaCare Solutions (S. Wilson):

- Cisco Transition
 - Agent UAT will begin the week of 10/15; continue through 10/26
 - 10/30 - UAT results will be reviewed with GSS management team
 - Training for all employees to tentatively begin on November 5th.
- Training Updates
 - Implemented Training Attendance Policy
 - Began with September 2012 OKC Training class
 - Implementing New Hire Graduation Ceremony in October All Hands Meeting
 - Public ceremony in front of staff; Supervisors assist in handing out Certifications
 - Next new hire training class in OKC - 10/29 (6 America's Employees)
 - Next new hire training class in Singapore - 10/22 (5 APJ Employees)
- LaCie Integration
 - Phase 1
 - Move all LaCie EMEA EndUser/Reseller support to OKC
 - Utilize LaCie Systems
 - Target Completion Date - 1/31/13

- Phase 2
 - Move LaCie America's EndUser/Reseller support to OKC
 - Utilize LaCie Systems
 - Target Completion Date - 04/30/13
- Phase 3
 - Integrate LaCie systems in Seagate systems
 - Target Completion Date - 6/30/13

● **Projects & Programs (G. Shin):**

● Programs and projects

- RMS replacement
 - SOW in discussion - Sign-off in progress. Changes from Candace Pritchard in review.
 - Investigating additional requirements from GSS group for integration to Sales force application.
 - Risk identification: meeting with different groups to create FMEA document.
- Virtual Receipt: Est 4 months, 70K, requesting resource commitment(ISS); working questions from Charan(IT) and posting Q&A in Virtual Receipts google doc.current as of 09/27. Still in progress
- UAT 023099 _CSO RMS SSD Receiving Note update-completed/passed 10/05/12
- CSO RMS Foreign Currencies pushed out to early CY2013 due to Virtual Receipt & Korea OOW priorities.
- China and India LCBET work request received. Priority 15 set by PMO. Commitment from IT to complete Nov. / Dec On Track
- Jasmine Goh in Calif training on rules with Kathy Grant. Ongoing through October 15th.
- Moovweb selected as vendor for mobile web development. Paperwork is being completed to enable Moovweb to begin work. It is anticipated that it will be complete next week. Once the functional requirements are fully fleshed out, development can begin.
- Contract to support 24-48 hour TAT for Canada UPS collection point in negotiations. Commitment from Logistics to support 24-48 hour turn-around-time to support Direct Retail customer returns and from UPS to provide supporting resources. In Progress
- 9/25 New Seagate preferred carrier LandStar for the America's to replace existing Seagate preferred carrier UPS at end of October - Working plan on implementation & notifying customers.
- DOA / LATE DOA changes in discussion with users. Kathy driving with Michelle. Need to add Barry sterling to authorization sign -off. (Michelle wrote up policy to get approved - still pending approval - Barry has approved - waiting for others - target approval by 10/1 to get implemented iLog rules in by 10/18)
 - Policy is approved. Michelle sending word file (rec'd Alan's final approval on 10/4). I need to submit iLog rule request to implement.
- iLog Rules: 8 in works for 10/9 and 10/15 promotions. 3 pending warranty approval, 3 pending production approval, 3 new.
- Ext Warranty for Disty UAT to start week of 10/15. UAT test plans uploaded in QC. Suzi working to connect SNs/customer to tests. There is some concern from IT that we want to test too much. Feel we are fine.

- Michelle and Kathy created a timeline (cheat-sheet) of warranty (fulfillment, decline, duration info) changes since 2011 to help for historical purposes. Michelle doing a once-over review and will publish. 26-Sep-12 The timeline does not include prior to Day 1 Samsung and the Cloud info. Will continue to work. We are adding the tracking #s that changed the policies as well so if any audit comes thru, we will have rule # - this is internal use only.
- Monthly PMO meeting. CVN for Latin America set at 13 to align with other CVC / CVN programs. Cisco replacement of Syntellect set at 30 (Commitment from IT that no conflicting work in progress to affect Nov / Dec implementation).
- Monthly Web PMO - Strategy and process development for project management being put in place. Reviewed existing process and group input on changes. Ongoing
- **Black Armor / Tappin Remote Update tutorials:**
 - Script created for final 2 videos and sent for VO recording
- **Convert KB Videos to YouTube:**
 - Jason S. has 519 candidates for conversion to YT format. We have setup a meeting for 09/28 to discuss process. Status has not changed
- KB link project is on track for completion by end of December.
 - Links that do not yet exist in Vignette that exist in the KB are being added. English only is being done at this time. Assessment of whether to translate to follow, though most likely older links won't be. Newer content as it is provided will most likely be translated.
- RMS Replacement - Mock up screenshot feedback being reviewed and addressed with Steve A.
- UPS Korea Collection Point Transition to Semas effective in October 2012.. (Decommission CPSNGKOR, CPSGDKOR, CPMALKOR) - Completed disable UPS Korea dated 10/03/2012.
- Quarter end activities: Cost of Quality; CSO Footprint Matrix
- SFDC/WCS/RMS interface pre GRS is in SOW phase with GSS Team...10/04/12
- Brazil microsite is to be decommissioned. It is currently on a month-to-month budget. Requirements are about 90% complete. The eCommerce system will require the most development; Vignette content is fairly straightforward and 50% complete already. Full requirements must be developed, sign-off received from stakeholders, and development coordinated for launch. Subhartha has indicated November would be timeframe for eCommerce system.
- Vietnam Transition: Change from Nam Khai Transportation to Mekong Cargo Freight. Go Live on 01-Nov-12
 - 03-Oct-12: Changes updated in RMS Staging.

VOC (L. Mickel): Maternity Leave until 8-Oct-12

Retail Product (E. Lueb):
Highlights and Status

- Phoenix - 48 DVT units use for OKC / Colorado/ Signapore testing. 40 units shipped to Jeff for Cupertino testing. An additional shipment of units will be built and sent after a round of hardware testing. These will be used for the Pre-release (BETA) testing. Survey sent out and responses due Monday.

- GoFlex - Memeo Windows update to add support for Windows 8 still pending waiting for an updated ETA.
- Backup Plus Dashboard Fall software update. 50 testers ready with hardware. Alpha software expected Friday 9/28. Survey ready to go out on Tuesday.
- Samsung - Updated Paragon driver coming to replace NTFS 3G driver used by Samsung (which wasn't compatible with Mountain Lion (new Mac OS). Software update received by Samsung team, but hasn't been release to us yet, still pending a decision on branding (they want to rebrand as Seagate/Samsung, advised against it since GoFlex and Backup Plus used it as Paragon and customers know that brand).. Will pass software to FDI team once received, to test with older Samsung external drives the Samsung team is focused on S2 and M3 only. .
- Apollo - Still no core team meetings. However did receive word that we will receive 100 unit for pre-release testing. Sent survey out to collect volunteers.
- Backup Plus - Created training for new Mac products. Updated web site with Windows drivers for the upcoming Thunderbolt product. New URL should go live early next week:
<http://www.seagate.com/www/support/thunderboltwin>
- Satellite - 1.3.6.001 firmware released. Updated App is live. App with fix for iPhone 4 pop-up message has been submitted and is expected to go live Sept 28. 6 negative reviews on App Store for current App, most seem to Wi-Fi connection issues which would be either the iPhone issue or they didn't update the firmware (like the description and pop-up and web site say to do).
- Satellite 4G - Talked to Yvette Brooks and she is going to setup a design review so I can add some input around battery concerns we found with Satellite. She will also touch base with Alan about core team representation. At this point it appears Verizon will totally own the relationship with the end user.

Retail Product (D. Lopez): **Highlights and Status**

- BlackArmor NAS - New BA NAS TappIn firmware was released for testing on Aug 15th.
 - Worked with marketing on email blast to registered users.
 - Hosting weekly meeting with TappIn, GlobalSCAPE and Seagate to address open issues
 1. Additional Licenses purchases - price, promotion, functionality
 2. RMA process validation
 3. Bugs and feature enhancements
 4. 3rd party ads in our branded app.
- Whitney Product Development Testing
 - Over 50 new bugs submitted to Monta Vista BugZilla prior to v9.5.
 - Firmware v9.5 released for testing on Aug 31st.
 - Firmware given to all 29 users.
 - User guide, box art, and QSG have been posted to the beta site for review.
 - Reviewed the Discovery Software and turned in feedback to UX team.
 - Developing alternative QSG / Use case expectation guides to take with me to HQ.
- FMEA and 8D
 - Choose Process: Salesforce - Data Path from Customer to Core Team.
 - Selected team members.
 - Begin targeting specific issues to consider that may cause data contamination or leave open user error.

Warranty Management (M. Cetlinski):**Highlights and Status**● **Warranty and Credit P/T -**

- 9-7 - Met with developers and they have a better understanding of business needs. Pending implementation for another round of UAT.

● **eCommerce Change Requests -**

- Brazil micro-site being decommissioned
 - 9-28 - Submitted final Work Request. However, site is being decommissioned 10-01. Request help to keep site running through CTS' budget from Alan (\$7k/month).
 - 10-05- Reviewed final request with business and more changes needed. Drafted new work request and will schedule another meeting for final review next week.

● **Continuation of 8D - for 8D- Inaccurate Warranty -**

- 9-7 - Worked with Sherry Dames and developed a report to test. Re-worked root cause with Chiye and Bruce. Do impact analysis of analysis initially performed and EDIS admin - re-reviewing report for more parts to add since first analysis.
- 9-14 - Finished Impact Reopened D3 Containment plan to continue analysis on missing parts.
- 9-21 -
 - More wrong warranty parts found - from end-dating rules.
 - 9-18 - Exported rules to analyze rules that end-dated from last two major warranty changes. Found some rules that were end-dated -- will compile and have corrected.
 - 9-20 - Exported rules and analyzing all rules from 07/01/2011 to ensure that proper warranty period is set for product segment - STILL WORKING.
 - 9-20- IT created report to show rules that are hitting default rules. STILL WORKING.
 - EDIS Admin reviewed test report for new PNs - found missing parts. PDH group recommended another query to capture missing PNs - will continue to test report for gaps.
 - Spoke to IT about simplifying rules table - I believe this would eradicate a lot of the issues - with other CSO projects, this won't be worked until January. Will meet next week to gather requirements.
- 9-28 - Continuing analysis on Rules. Re-worked Incident Map with Mary Pampero and Bruce. Testing on sample report designed to replace current one.
- 10-05 - Continuing to test report. Spoke to IT about submitting requirements for customized report. Will set-up meeting with EDIS Admin for requirements. Also, spoke with IT about shipments report - set-up meeting next week to further discussion.

● **Exceptions:**

- **Canal+** - AM from EMEA has request from company to return ~23k. Canal + has contract with Samsung for 2 years warranty and other requirements. Previous parameters provided by SEC do not match contract parameters. I am requesting validity of contract and then we will proceed with updating warranty. 8-16 - Approved and pending implementation into production. On -hold because UAT failed and IT person out until 8-21. 8-24- Fixed rules and implemented. 8-31 - New products identified by Sales - will review next week. 9-14 -New parts identified - requesting more information from Sales.
- **China Buffer program** - rule request for RE default for Nearline - requested the process, as well as the risk assessment of the program. 8-14 - Submitted request for approval. 8-31- Pending Jason (Pricing) 9-28- Pricing requesting info from Sales.
- **Russia - RFC only request** - Requested sales volume for MC = 8-10k/qtr. Business justification and ITA confirmation for request are the same. Pending Alan's direction. 8-10 - Spoke to Alan about justification and he said to proceed with submitting for approval. 8-14 Submitted for approval after speaking with Alan. 8-31 - Pending Alan and Barry. 9-7 - Barry rejected. 9-10- Barry approved - routed to iLog for implementation.

- **Calcomp** - Sales (STX) would like to revert to 1 year warranty (plus channel time) for DS for OEM and DIST. Need to request benefit to Seagate or cost analysis of this request from Bryan as Rajeev is out this week. 8-10 - Still pending response. Sent reminder. 8-14 Sent another request. 8-23 - Provided some Sales figures to finance for analysis. 8-31 - Pending Finance. 9-14-Sent Sales volume to Finance for analysis. 9-21 - Sent a reminder. 9-28 - Never received Sales justification.
- **Starline** - From RFC to RE for years 3-5 on Nearline OEM - requested financial analysis from Walter and Bryan as Rajeev is out. 8-10 - Still pending response. Sent reminder. 8-24 - Proceeded with submitting request. 8-31 - Rejected by Pricing - requested clarification. Pricing pushing back to Sales.
- **Vietnam - RE Only** - approved in my system but rejected in Kathys by Barry. 8-14 - Nudged Barry - he just got back from surgery and catching up with request. 8-31- Nudged Barry again. 9-7 - Gavin will talk to Barry when he back from his vacation. 9-28 - Pending implementation.

● **Regional Returns:**

- 9-28 - Sent FQ3 and FQ4 data to Sales.

● **New attribute for SSD Usage-Based warranty or warranty features.**

- 9-14 - Submitted ECR request - pending IT.

● **Documentation:**

- 9-21-Helped to draft update to Warranty Void Clause - Workload Specifications (Tire warranty) - This has been scratched. PLM thinks language is too harsh (MC 9-28)
- 9-28 - AD policies submitted, as well as Internal policy, however, they will need revisions for the Constellation CS credit scale changes.
- 10-05 - Finished approvals for Samsung and Seagate policies and distributed. Started work on updating Product and Customer Exceptions. DOA Policy approved - sent to Kathy and Chiye. Will arrange discussion for implementation.

● **Audit:**

- Finalizing C292 Audit for FQ113.

Warranty/Credit (W. Rush):

Highlights and Status

- Shu, Kady, and I finalized the BRD for Next Model and development work is starting in SMA IT overseas. Shu is on vacation for 3 weeks but work is continuing overseas. It looks like a November promotion.
- FY13Q2 Quarterly Credit Pricing is near completion. A subset of Sony is the lone SPA yet to be delivered. Negotiations are not complete. I am assessing the impact, Kady and I have a few options we will explore next week. There was a MOFCOM concern surrounding the loading of Credit Pricing for Samsung returns. I met with SMA IT and Pricing. The current plan is to migrate Samsung credit pricing into the "S" bill to location. Also, I'm working with RMS Support and QIS to establish credit pass throughs so "S" bill to's are used to retrieve prices and for credit \$'s.
-

Travel:

- Alan Clark: Sep 30 - Oct 3 OKC Customer Service Week
- Alan Clark: Oct 3 - Oct 4 P. Connolly Off-Site

- Alan Clark: Oct 12 - Oct 22 Singapore
- Alan Clark: Oct 22 - Oct 26 R. Lane Live Staff

Time-off/Vacation:

- Eric Lueb: Oct 15 - Oct 19
- Dustin Lopez: Nov 26 - Dec 7

EXHIBIT 47



DECLARATION OF CONFORMITY

according to EN ISO/IEC 17050-1:2010

Manufacturer's Name and

Address:

Seagate Technology LLC
10200 S. De Anza Blvd
Cupertino, CA 95014
United States of America

Phone 1.800.SEAGATE
Fax 408.658.1764
Web www.seagate.com
Email sunnyvale.system.validation@seagate.com

EU Authorised Representative

Director of Operations
Seagate Technology International
Koolhovenlaan 1
1119 NB Schiphol Rijk
The Netherlands

TYPE OF EQUIPMENT: External Storage Device

REGULATORY MODEL: SRD00F2

MARKETING MODEL: Backup Plus Desktop Drive; Backup Plus for Mac Desktop Drive

TRADE/BRAND NAME:



2013

Year CE marking was first
affixed to declared product



Seagate Technology, Incorporated, as the responsible party for regulatory compliance, declares under our sole responsibility that as delivered the described product is in conformity with the Low Voltage Directive 2006/95/EC, Commission Regulation (EC) No 1275/2008, following the provisions of ErP Directive 2009/125/EC, and EMC Directive 2004/108/EC, EU RoHS Directive 2011/65/EU and carries the CE-marking.

The described product has been assessed and determined compliant with the following standards:

SAFETY: EN 60950-1:2006 +A1:2010 +A11:2009 +A12:2011

RoHS: EN 50581:2012

EMC: EN 55022: 2010
EN 55024: 2010
AS/NZS CISPR 22: 2009/Amdt 1:2010 Class B
EN 61000-3-2: 2006+A1: 2009+A2: 2009
EN61000-3-3: 2008

SUPPLEMENTARY INFORMATION: This product has been tested and found to comply with the electromagnetic compatibility (EMC) limits for a Class B digital device pursuant to the listed directives, regulations and standards. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential or business environment. The equipment was tested in a typical configuration.

Cupertino, CA, USA

Place of Issue

Dec 20, 2013

Date of Issue

BackupPlus_SRD00F2_CE_DoC_11212013

Document Control Tracking Number

Eric Su

Signature

Eric Su

Full Printed Name

Staff Engineer, System Validation Engineering, Seagate Technology LLC

Position/Title

EXHIBIT 49

From: Lilly Luk <lilly.luk@seagate.com>
Sent: Friday, March 9, 2012 3:40 PM
To: Paul Mcparland <paul.mcpaland@seagate.com>
Cc: Eric H Lueb <eric.h.lueb@seagate.com>; Eric Y Su <eric.y.su@seagate.com>; Warren Berman <warren.berman@seagate.com>; Marc Lee <marc.lee@seagate.com>; Homer Pitner <homer.pitner@seagate.com>; Phil Rich <Phil.Rich@seagate.com>
Subject: Re: [REDACTED]

This is probably the same issue I am currently working with Eric this week. Both Eric and I can't duplicate the issue so far.

suggest Eric to get more information on the failure:

- 1) FW800 firmware version,
- 2) HDD SN, run disk test if any HDD issue
- 3) couple thing to ask customer to do:
 1. Install [this update for 10.7.3 TimeMachine issues](#) (not specifically the ones he has but possibly relevant, Apple never puts the full story in the update description). Test for a few days or until corruption occurs.
 2. Use a different size drive, 2TB or less, if this is reliable, the drive size would seem to be at issue, This might point to a Time Machine bug or one somewhere else.

I also asked Initio to troubleshoot the issue this week, and they have not been able to duplicate the issue for 2 day testing till now either:

Initio Test configuration:

3TB Seagate Baracuda HDD

Firmware version: SEAG_Combo_1615_V131rc02.bta.

SeaGate Goflex board configured to detect the sector size 4KB when HDD greater than 2TB.

Intel Mac Pro Dual Xeon 2GHz.

OS version 10.7.2

FireWire 800 cable connected from Mac Pro to SeaGate Goflex board with 3TB attached.

Test result: Not able to duplicate the problem.

- The Mac Pro system able to detect the 3TB HDD, partition, and format without error.
- Copy many files from 5MB to 3.49 GB data from DVD and from System HDD to SeaGate Goflex without any error or corruption.

Lilly

On Fri, Mar 9, 2012 at 3:19 PM, Paul Mcparland <paul.mcparland@seagate.com> wrote:

Anybody know what is going on here?

Begin forwarded message:

From: Homer Pitner <homer.pitner@seagate.com>
Date: March 9, 2012 3:05:00 PM PST
To: Faheem Dani <Faheem.Dani@seagate.com>, Warren Berman
<warren.berman@seagate.com>, Paul Mcparland <paul.mcparland@seagate.com>
Subject: Fwd: [REDACTED]

You guys know anything about this?

----- Forwarded message -----

From: Alan W Clark <alan.w.clark@seagate.com>
Date: Fri, Mar 9, 2012 at 2:25 PM
Subject: Fwd: [REDACTED]
To: Danny G Medina <danny.g.medina@seagate.com>, Homer Pitner
<homer.pitner@seagate.com>, Marc Lee <marc.lee@seagate.com>, Troy D Beaty
<troy.d.beaty@seagate.com>

Just got off the phone with Joni clark.

How big is this issue, Troy, we need to capture the forum threads on this asap

Homer : Is your team aware of the issue, is there a solution

AC

----- Forwarded message -----

From: Joni J Clark <joni.j.clark@seagate.com>

Date: Fri, Mar 9, 2012 at 2:20 PM
Subject: Fwd: [REDACTED]
To: Alan W Clark <alan.w.clark@seagate.com>

Here is the customer and a summary of his issues.

j

*Joni Clark | Seagate Technology
Sr. Product Marketing Manager
720-684-1145 | joni.j.clark@seagate.com*

Come see and hear about the new FAST Factor by Seagate:
<https://www.brainshark.com/seagate/FASTER>

This e-mail message and any files transmitted with it are for the sole use of the intended recipient(s) and may contain confidential and privileged information. Any unauthorized review, use, disclosure, or distribution is prohibited. If you are not the intended recipient, please contact the sender by reply e-mail and destroy all copies of the original message.

----- Forwarded message -----

From: [REDACTED]
Date: Fri, Mar 9, 2012 at 1:54 PM
Subject: [REDACTED]
To: Joni J Clark <joni.j.clark@seagate.com>

Joni,
See below another reply to my forum post below. There is a wide spread issue here and I am once again being asked to swap out drives. I don't believe it is a drive issue but a software drive issue. I have yet to speak to a engineer to walk them through the issue. This issue is going to be a big problem for anyone using this disk and OS X 10.7.3. SEE THE BELOW POST FROM ANOTHER USER:

Posts: 4
Registered: 03-08-2012

0

Re: **WARNING 4TB OR SMALLER GOFLEX MAC WILL NOT WORK WITH OS LION 10.7.2 OR 10.7.3**

Options

03-08-2012 08:46 PM

Hi,

I experienced the same problem ... There are a couple of work arounds involved in getting this to work without Lion Crashing.

1. Uninstall the Seagate software ... The uninstaller is part of the installer. When it gives you the option to do a custom installation (screen 4) select it. Click the check box off next to "Seagate GoFlex Features", and click the check box on next to "uninstall". Then click the Install button. That will remove the Seagate GoFlex Driver package (regretfully you will lose the nifty lights, but it solves the crashing problem). Completely shut down your Mac, then reboot. This is the only fix for the crashing problem that I know of, I think the driver is not compatible with 10.7's sandboxing methodology, but Seagate has not gotten around to correcting it yet. Regretfully uninstalling the driver creates another problem, so move onto number 2.

2. Once you uninstall the drivers you might run into another problem. Every time you put the computer to sleep the drive's header may take minor damage causing the drive to be unmountable by the OS. The only solution I have for this problem is instead of putting the computer to sleep you will want to shut the computer down. This is only a workaround until Seagate fixes the driver software. If you want to try putting the computer to sleep have Disk Utility, Alsoft's Disk Warrior, or Micromat's Techtool Pro at the ready. Remember to backup your files before you try this, and do so at your own risk.

I hope this helps.

On Mar 9, 2012, at 8:43 AM, Joni J Clark wrote:

Yes agree! I'm at home still but I will take care of this today. Will call you a little later today.

Thanks for keeping me in the loop.

J

Joni Clark
Seagate Technology
720-684-1145 office
970-302-4076 cell

On Mar 9, 2012, at 6:13 AM, [REDACTED] wrote:

Joni,

I am a bit at my wits end on this issue. I was contacted by support via a generic email asking for basic additional info that was already in the email I provided you and on my forum post. I happily accommodated them and replied to the support@seagate.com email address and asked for them to receive acknowledgment of the email. I have yet to receive an acknowledgment or another email or a call.

I can tell you point blankly the way this concern is being handled is the antithesis of when I worked with you. Other have posted to the forum stating they have had the same issues I have but if the resolution is handled the way that mine is being handled I can't imagine that those folks will stick with Seagate.

So it is been 4 days since I replied to their email and no response, no follow-up and no acknowledgement of any additional communication from me.

What should I do now?

[REDACTED]

On Mar 6, 2012, at 3:39 PM, Joni J Clark wrote:

I think we are good for now but let's stay in touch on this one.

j

*Joni Clark | Seagate Technology
Sr. Product Marketing Manager
720-684-1145 | joni.j.clark@seagate.com*

Come see and hear about the new FAST Factor by Seagate:
<https://www.brainshark.com/seagate/FASTER>

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On Tue, Mar 6, 2012 at 1:36 PM, [REDACTED]

<[REDACTED]> wrote:

You are the best. Feel free to pass on all my contact info. Happy to help. I was due to speak with you today at 2:30pm but there doesn't seem to be a need since the ball is rolling in the right direction (hopefully) unless you need to speak with me. I will keep you apprised on the progression of this fix if there is one. Richard

On Mar 6, 2012, at 3:33 PM, Joni J Clark wrote:

I hope they reach out to you. I told them who you were and what you did for us on [REDACTED] so if they are smart they'll pull you in.

j

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On Tue, Mar 6, 2012 at 1:30 PM, [REDACTED]

<[REDACTED]> wrote:

Joni,

You are the best. I hope I didn't create too much of a firestorm but as I mentioned I have been dealing with this since mid February and the go to solution was to

keep sending out new drives which is a costly and ineffective fix. Let me know if there is anybody I can email or talk to directly to help provide more clarity on this issue.

Once again thank you for the support.

[REDACTED]

On Mar 6, 2012, at 3:24 PM, Joni J Clark wrote:

Sure did and I got the right folks involved and they tell me they are on it but I will follow up with them in a couple of days to make sure.

j

*Joni Clark | Seagate Technology
Sr. Product Marketing Manager
720-684-1145 | joni.j.clark@seagate.com*

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On Tue, Mar 6, 2012 at 12:49 PM, [REDACTED] wrote:

Joni,

Did you get the email that had all the data?



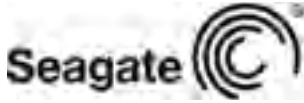
--
Best Regards
AC

--
Homer Pitner
Executive Director
Product Development
Seagate Retail products
408.658.1373

--
Regards,

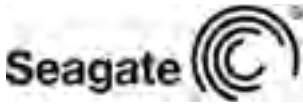
Lilly Li Luk
Retail Test Validation
Seagate Technology
10200 S. De Anza Blvd., Cupertino, CA 95014
(MailStop) CPCA01A33
(Office) 408-658-1271
(Fax) 408-658-1764
(Mobile) 650-269-8968
Lilly.Luk@seagate.com

EXHIBIT 51



Agreement No. 149738

Disc Depot Hardware and Software Loan Agreement



Agreement No. 149738

_THIS AGREEMENT IS MADE BETWEEN BACKBLAZE FOR ITSELF AND ITS AFFILIATES ("CUSTOMER") AND SEAGATE TECHNOLOGY LLC FOR ITSELF AND ITS AFFILIATES ("SEAGATE"), A DELAWARE LIMITED LIABILITY COMPANY WITH ITS PRIMARY PLACE OF BUSINESS LOCATED AT 10200 S. DE ANZA BLVD., CUPERTINO, CA 95014. "AFFILIATE" MEANS AN ENTITY THAT, DIRECTLY OR INDIRECTLY, OWNS OR CONTROLS, IS OWNED OR CONTROLLED BY, OR IS UNDER COMMON OWNERSHIP OR CONTROL WITH, ANOTHER ENTITY. FOR THE PURPOSES OF THE FOREGOING, "OWN," "OWNED," OR "OWNERSHIP" MEANS OWNERSHIP OF FIFTY PERCENT (50%) OR MORE OF THE STOCK OR OTHER EQUITY INTEREST ENTITLED TO VOTE FOR THE ELECTION OF DIRECTORS OR AN EQUIVALENT BODY. THE ENTITY WILL BE DEEMED TO BE AN AFFILIATE ONLY SO LONG AS SUCH OWNERSHIP OR CONTROL EXISTS.

This Agreement is for "Disc Depot" Disc Drive Test Hardware ("Hardware") and Software ("Software") individually, or as the "System" collectively.

License Grant. Seagate grants to Customer a site specific, nonexclusive, nontransferable, limited license to use the System for testing of Seagate products. Customer has the right to use the System only at the site(s) set forth in the Supplement and any subsequent Supplements. Additional Systems may be deployed at site(s) described in subsequent Supplements. Each Supplement will be incorporated into this Agreement upon execution and will define: (a) location of use, (b) hardware serial number for the location, and (c) number of software licenses at location.

Customer will use the Hardware exclusively with the Software.

Except as expressly authorized above, Customer shall not: copy, in whole or in part, any Hardware or Software or related documentation; modify the Hardware or Software; reverse compile, reverse engineer, disassemble or reverse assemble all or any portion of the Hardware or Software; or rent, lease, license, sublicense, distribute, sell, or otherwise transfer the Hardware or Software. Specifically, Customer shall not remove the Software from the Hardware. Customer obtains no rights in the Hardware and Software except those given in this limited license.

Ownership. Unless there is a separate written agreement between Customer and Seagate, the System and any related documentation is owned by Seagate. The Hardware and Software, as well as the System as a whole, is protected by United States and international patent, copyright, and trade secret laws. Customer will not remove, alter or destroy any copyright, proprietary, or confidential notices placed on the System or any related documentation. Customer agrees that aspects of the System, including the specific operation, design, and structure of individual components, constitute trade secrets of Seagate. Customer agrees not to disclose, provide, or otherwise make available such trade secrets or copyrighted material in any form to any third party without the prior written consent of Seagate. Customer agrees to implement reasonable security measures to protect such trade secrets and copyrighted material. This section will survive any termination of this agreement.

NO WARRANTIES. THE SYSTEM AND ANY RELATED DOCUMENTATION ARE PROVIDED TO CUSTOMER "AS IS." SEAGATE MAKES NO WARRANTIES, EXPRESS OR IMPLIED, AND EXPRESSLY DISCLAIMS ALL REPRESENTATIONS, ORAL OR WRITTEN, TERMS, CONDITIONS, AND WARRANTIES, INCLUDING BUT NOT LIMITED TO, IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NONINFRINGEMENT. WITHOUT LIMITING THE ABOVE, CUSTOMER ACCEPTS THAT THE SYSTEM MAY NOT MEET CUSTOMER'S REQUIREMENTS, OPERATE ERROR FREE, OR IDENTIFY ANY OR ALL ERRORS OR PROBLEMS, OR DO SO ACCURATELY. This Agreement does not affect any statutory rights Customer may have as a consumer. ALL DISCLAIMERS HEREIN SURVIVE TERMINATION.

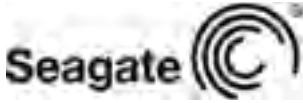
LIMITATION ON LIABILITY. IN NO EVENT WILL SEAGATE BE LIABLE TO CUSTOMER, CUSTOMER'S CUSTOMERS, OR OTHER USERS, FOR DAMAGES OF ANY KIND INCLUDING BUT NOT LIMITED TO DIRECT, CONSEQUENTIAL, SPECIAL, INCIDENTAL, OR INDIRECT DAMAGES OF ANY KIND ARISING OUT OF THE LICENSE OF, USE OF, OR INABILITY TO USE THE SYSTEM, INCLUDING WITHOUT LIMITATION DATA LOSS, EVEN IF SEAGATE OR ITS SUPPLIERS HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. SOME JURISDICTIONS DO NOT ALLOW FOR LIMITATIONS ON CONSEQUENTIAL DAMAGES.

Log files/contact information. Upon request by Seagate, Customer will provide Seagate with logs (un-edited) verifying that Customer is continuing to use the System to test Seagate hard disc drives. Customer will designate a contact person for this purpose and provide this person's contact information to Seagate.

Term. This Agreement will be effective on the date of last signature. However, Seagate may immediately terminate this Agreement and related Supplements at any time if Customer fails to comply with any term or condition or if Customer ceases to purchase and/or test Seagate hard disc drives using the System with written notice to Customer. Upon any such termination, Customer must cease using the System and must follow Seagate's instructions regarding return of the System and bear any costs associated with the return of the System to Seagate.. Customer should contact Seagate at time of return to determine return procedure at that time.

Right of Replacement/Repair. Seagate agrees to replace hardware found defective by Customer for a period of one (1) year following execution of this Agreement. For avoidance of doubt, "Hardware" does not include adapters and other sacrificial parts such as drive trays and/or back planes to be used with the System. Customer may purchase replacement parts and spares only for the purpose replacing failing or otherwise defective parts of the Hardware. In no case will Seagate be responsible for replacement or supply of cables or other external components necessary for use of the Hardware.

Customer is responsible for routine maintenance of equipment, including replacement of sacrificial parts such as test trays and adapters when they reach end of life or are damaged, and including installation of new software. Required repairs beyond routine

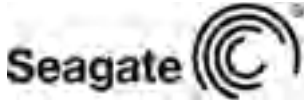


Agreement No. 149738

maintenance may be performed by Customer or the equipment may be sent back to Seagate in Longmont, Colorado, at Customer's expense, for repair.

International Trade Compliance. The System is subject to the customs and export control laws and regulations of the United States and the country in which they are received, including the U.S. Export Administration Regulations. Customer will comply with all applicable tax, import, export, re-export and foreign policy controls and restrictions of the U.S. and the country in which Customer is located. The System may not be sold, leased or otherwise transferred to restricted countries as defined by the United States federal government. In addition, Seagate is prohibited by US law from receiving, repairing or replacing drives under warranty from these restricted countries and Customer agrees not to return any drives from restricted countries to Seagate for warranty replacement. Customer, on behalf of itself and its affiliated companies, employees, and agents, acknowledges that it will comply with and abide by these restrictions and all other applicable laws and regulations.

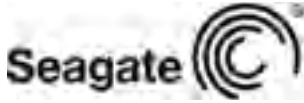
Miscellaneous. Recipient may not assign this Agreement without Seagate's prior written consent. Any attempted assignment without such consent is void. This agreement may only be modified in writing signed by both parties. The parties disclaim the application of the United Nations Convention on the International Sale of Goods. This Agreement will be governed by the laws of the State of California and the United States of America, without regard to conflict of law principles. The terms of this Agreement are severable. If any term is unenforceable for any reason, that term will be enforced to the fullest extent possible, and the Agreement will remain in effect.



Agreement No. 149738

BACKBLAZE
500 Ben Franklin Court
San Mateo, CA 94401
United States of America

Seagate Technology LLC
10200 South De Anza Boulevard
Cupertino, CA 95014-3209
United States of America



Agreement No. 149738

A handwritten signature in black ink, appearing to read "Tim Nufire".

By (Duly Authorized)

Tim Nufire

Typed Name

VP of Engineering

Title

8/8/2014

Date

By (Duly Authorized)

Typed Name

Title

Date

Seagate Originator: Stuart Ray Ball

EXHIBIT 54

From: John D Grieci <john.d.grieci@seagate.com>
Subject: Re: 8D Grenada OEM & Disti ORT TVM DOM WW1251 Trigger (SSO# 0216)_Update_Jul11
To: Sai S Varanasi <sai.s.varanasi@seagate.com>
Cc: Michael Crump <Michael.R.Crump@seagate.com>, KianFatt Chong <kianfatt.chong@seagate.com>, Pianguetai Sivaratana <pianguetai.sivaratana@seagate.com>, Hari H Narayan <hari.h.narayan@seagate.com>, Jeffrey E Mason <jeffrey.e.mason@seagate.com>, Mark E Re <mark.e.re@seagate.com>, Jeff Nygaard <jeff.nygaard@seagate.com>, Frank Murphy <Frank.Murphy@seagate.com>, Alan B Johnston <alan.b.johnston@seagate.com>, Jeffrey K LaCroix <jeffrey.k.lacroix@seagate.com>

These failure rates are extremely high for single cause:

d. Instability failure rate for Key OEM = 0.49%, Std OEM= 0.70% and Disty = 1.7%

On Thu, Jul 12, 2012 at 5:40 PM, Sai S Varanasi <sai.s.varanasi@seagate.com> wrote:

John,

As we discussed this particular trigger in TVM seems to be related to particle contamination. FA is underway.

At a higher level, Grenada triggers are mainly due to head instability and particle related issues.

Instability:

a. We identified head instability issue with the first SSO in dec/jan. As a company we made a decision to use the 'bad' wafer/slider material to meet Q3/Q4 volumes. We expected to finish using this material in middle of Q4, however we will continue to consume until WW17 (via disty/SBS config). To improve OEM performance we are using non-SLT-05 for OEMs.

b. To further improve OEM performance we have tighter OEM cert specs. I suspect this is another reason why OEM performance in ORT is improving but Disty is not (even with non-SLT05 material).

c. Work is underway to understand additional stress in Grenada drive that might be increasing this failure rate.

d. Instability failure rate for Key OEM = 0.49%, Std OEM= 0.70% and Disty = 1.7%

Particles:

a. NHK failure rate continues to be 3-4X higher than MPT. Starting this week we should have much higher mix of MPT in OEM (and hence increasing NHK ratio into Disty).

b. In addition to NHK, we also have other normal particle contam contributors (Talc, Slider particles, SST, AIO etc).

OEM ORT raw failure rate (starting to improving....)

Disty ORT raw failure rate (not improving.....ignore last two weeks because runtime is short)

Thanks

Sai

China# 18662271002

US# 303 913 9309

----- Forwarded message -----

From: **John D Grieci** <john.d.grieci@seagate.com>

Date: Thu, Jul 12, 2012 at 6:26 AM

Subject: Re: 8D Grenada OEM & Disti ORT TVM DOM WW1251 Trigger (SSO# 0216)_Update_Jul11

To: Chanond Tesavibul <chanond.tesavibul@seagate.com>

Cc: Michael R Crump <Michael.R.Crump@seagate.com>, Hari H Narayan <hari.h.narayan@seagate.com>, Sai S Varanasi <sai.s.varanasi@seagate.com>, "wilson.z.zhang" <wilson.z.zhang@seagate.com>, YehJuang Phang <yehjuang.phang@seagate.com>, Yan Liao <yan.liao@seagate.com>, Run Zhang <run.zhang@seagate.com>, Jun Huang <jun.huang@seagate.com>, Leong Hooi Tan <leonghooi.tan@seagate.com>, JunDui L Lu <JunDui.L.Lu@seagate.com>, Ke X Xu <ke.x.xu@seagate.com>, KokChiang Lau <kokchiang.lau@seagate.com>, KiatChoon Seow <kiatchoon.seow@seagate.com>, "Piangruetai.Sivaratana" <Piangruetai.Sivaratana@seagate.com>, Nuttaset Luetragul <nuttaset.luetragul@seagate.com>, MeiYu C Cui <meiyu.c.cui@seagate.com>, GuoPing Gui <guoping.gui@seagate.com>, "Jerry.CC.Seh" <Jerry.CC.Seh@seagate.com>, Suangsuda Saengarammanojit <suangsuda.saengarammanojit@seagate.com>, Niran Lersnimitthum <Niran.Lersnimitthum@seagate.com>, Chittiporn Pupaichitkul <chittiporn.pupaichitkul@seagate.com>, Wibulporn Nilnam <wibulporn.nilnam@seagate.com>, Jimmy S Sin <jimmy.s.sin@seagate.com>, Pat Dewey <pat.dewey@seagate.com>, Brent VanDerVliet <Brent.VanDerVliet@seagate.com>, Timothy J Peterson <timothy.j.peterson@seagate.com>, Michael L Foye <michael.l.foye@seagate.com>, Sittipong Jitsiriboon <sittipong.jitsiriboon@seagate.com>, Gary Kelsic <Gary.F.Kelsic@seagate.com>, Michael L Cook <michael.l.cook@seagate.com>, Kevin D Stenvall <kevin.d.stenvall@seagate.com>, Phinyada Phuwapariyathorn <phinyada.phuwapariyathorn@seagate.com>, Donald G Smith <donald.g.smith@seagate.com>, Matt Sadafi <matt.sadafi@seagate.com>, Krishnan Subramanian <Krishnan.Subramanian@seagate.com>, Glen D Almgren <glen.d.almgren@seagate.com>, Frank Murphy <frank.murphy@seagate.com>, Tao Bai <tao.b.bai@seagate.com>, Qian G Gu <qian.g.gu@seagate.com>, Jariya Poonsawat <jariya.poonsawat@seagate.com>, Oran Kuskul <Oran.Kuskul@seagate.com>, Chris G Labbe <chris.g.labbe@seagate.com>, Duongamol Anakamancee <Duongamol.Anakamancee@seagate.com>, Orawan Wiwattanajit <orawan.wiwattanajit@seagate.com>, Sarun Nantavisuth

<sarun.nantavisuth@seagate.com>, Wasana Ruamsup
<wasana.ruamsup@seagate.com>, Jeffrey E Mason <jeffrey.e.mason@seagate.com>

Folks,

What are we doing here with Granada? We seem to trigger often. We shipped 145K drives and we are holding 31K drives to screen I guess? This makes no sense!!! We are not managing quality here, we are just shipping product that will bite us later.

We NEED a longer term plan here. This drive does not seem like a good drive and feels a lot like Compass??

Can we get a plan here on what we are going to do and should we stop shipping the drive altogether until we have identified the root cause?

Do we need to get on the phone to discuss?? I get really nervous when we have 5 failures out of 60 drives??

Please let me know!

John

On Thu, Jul 12, 2012 at 12:19 AM, Chanond Tesavibul
<chanond.tesavibul@seagate.com> wrote:

Mike,

Please see the update in Blue

A: Product / Problem (Issue)

Grenada OEM and Disty DOM1251 TVM test detected 5 failures out of 60 drives tested, the failure rate is 8.3% which is higher than trigger limit at 3%.

Failures mode are: 3x Modulation, 1x Degraded Head and 1x NMD.

Factory quality agree upon CEE and FPT team to quarantine drives from DOM1251 all 3 sites (Korat, Wuxi and Suzhou) residing in FGI and WIP to be quarantined for treatment.

B: 8D Driver & 8D Owner(s)/Org

8D Owner: Piangruetai (Ops)
 8D Quality Lead: Chanond T.

C: Drives Impacted (Cus-Tab)

Total affected quantity = 176761 drives.

Quantity at FGI = 31,211 drives

Quantity in WIP = 143 drives. (Pending addition form SuZhou and Wuxi)

Quantity shipped to customer = 145,407 drives. (Pending addition form Wuxi)

ORT	Korat	SuZhou	Wuxi	Total
WIP	143	1331	160	1643
FGI	3336	20515	7360	31211
Ship	23477	121930	86589	231996
Total	26956	143776	94109	264841

D: Drives In Field/Hubs

231,996 drives

E: Summary & Status

Affected Drive quarantined, WIP and FGI pending for Paper sort and assessment.
 WW1302

Paper sort criteria already provided and released by product engineering.
 Jul 07,2012

The paper sort screening criteria are:

(1). From Table "P_TCS_ZN_SUMMARY" at CRT2 operation, Fail if: 'Max(TCS)' > 0.35 <== Max 'TCS' on each drive

(2). From Table "P109_UNSAFE_SUMMARY" at FNC2 operation, Fail if 'Max(Max(FVGA_ERR_CNT))' > 540

Base on these 2 criteria, screening can capture 3/5 failures (2x Modulation and 1x Head

Degraded) which 5.6% got screened out.

F: Root Cause

FA under finding the real root cause.

G: Containment

1. FIS crunch and quarantined affected drives in FGI, Stop pack has been created. 3sites QA / Process. -- Jul 06 Done
2. Provide Affected drives screening criteria Jul 06 Done PE / Wibulporn N. --
3. Paper sort affected vintage drives. -- WW1302 / On going Process / MFG
4. 7days Reliability test assessment. Reliability -- WW1302 / On going Process /
5. Review assessment result. -- TBD Reliability

H: Customer Communication

No,

I: Next Steps

Follow up CAPA and validation fix effectiveness.

Regards,
Chanond

--

SeaTel : 8-470-3509

--

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Senior Vice President, Customer Advocacy
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O 408-658-1166
M 508-254-4174

--

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--

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Cupertino, California

john.d.grieci@seagate.com

O 408-658-1166

M 508-254-4174

FED_SEAG0060976**Metadata**

Attach Counts	0	ORIGINAL
CC	Michael Crump <Michael.R.Crump@seagate.com>; KianFatt Chong <kianfatt.chong@seagate.com>; Piangruetai Sivaratana <piangruetai.sivaratana@seagate.com>; Hari H Narayan <hari.h.narayan@seagate.com>; Jeffrey E Mason <jeffrey.e.mason@seagate.com>; Mark E Re <mark.e.re@seagate.com>; Jeff Nygaard <jeff.nygaard@seagate.com>; Frank Murphy <Frank.Murphy@seagate.com>; Alan B Johnston <alan.b.johnston@seagate.com>; Jeffrey K LaCroix <jeffrey.k.lacroix@seagate.com>	ORIGINAL
Custodian	Crump_Michael	ORIGINAL
Custodian Other	Crump_Michael	ORIGINAL
DATERECEIVED	7/13/2012	ORIGINAL
DATESENT	7/13/2012	ORIGINAL
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FED_ENDATTACH	FED_SEAG0060982	ORIGINAL
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FILESIZE	53245	ORIGINAL
FROM	John D Grieci <john.d.grieci@seagate.com>	ORIGINAL
MD5 Hash	9C507FEB799ACA5AC4B34489883FD22	ORIGINAL
Message_ID	<CAMVg--nepNN_0K+zgENWn9Gxu=sZCHxKKx_twz28q+nbPjaV3w@mail.gmail.com>	ORIGINAL
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RecordType	E-MAIL	ORIGINAL
Relativity Image Count	7	ORIGINAL
Relativity Native Time Zone Offset	-8.00	ORIGINAL
TIMERECEIVED	6:44 AM	ORIGINAL
TIMESENT	6:43 AM	ORIGINAL
TO	Sai S Varanasi <sai.s.varanasi@seagate.com>	ORIGINAL

EXHIBIT 55



Product Manual

Seagate[®] Desktop HDD

Standard models

ST3000DM001
ST2000DM001
ST1500DM003
ST1000DM003
ST750DM003
ST500DM002
ST320DM000
ST250DM000

Self-Encryption models

ST3000DM002
ST2000DM002
ST1000DM004

Gen 14
100686584
Rev. L
January 2015

Document Revision History

Revision	Date	Description of Change
Rev. A	08/19/2011	Initial release.
Rev. B	09/01/2011	Updated decibel specifications, start/stop times; Table 3; mounting drawing.
Rev. C	10/20/2011	Updated voltage tolerance specifications.
Rev. D	01/17/2012	Corrected Table 1 (Altitude, operating) specification and Table 5 (Idle2).
Rev. E	06/11/2012	Updated Index.
Rev. F	09/05/2012	Added 2.5A spin-up code option (Table 1 and Table 2); page 17.
Rev. G	10/01/2012	Updated Table 1 and Table 2 with rated workload information. Updated DC power requirements (Tables 1, 3 and 4).
Rev. H	03/21/2014	Revised Rated Workload statement (pages 5 & 7); LP height updated & new mechanical drawings (pages 4, 9 & 20-21); Revised max storage note (page 13)
Rev. J	05/08/2014	Updated product name (pages fc, 2, 19 & 22) and Add metric "mm" values to mechanical drawings. (pages 20-21).
Rev. K	08/28/2014	Add SED models and SED Section 4.0 (pages: fc, 2, 4, 7, 22-23 & 29)
Rev. L	01/26/2015	Applied new logo (pages: fc & bc), applied latest page numbering convention (pages: all), added AFR = <1.0% & update Rated Workload text (pages: 9 & 11), added Case Temp note & changed "&" to "%" in Storage note (page: 17), add Reliability Section 2.12 (page: 20), cleaned up text in Mechanical Drawings (pages: 24-25) & revised SED section 4.0 (pages: 26-27).

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When referring to drive capacity, one gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes. Your computer's operating system may use a different standard of measurement and report a lower capacity. In addition, some of the listed capacity is used for formatting and other functions, and thus will not be available for data storage. Actual quantities will vary based on various factors, including file size, file format, features and application software. Actual data rates may vary depending on operating environment and other factors. The export or re-export of hardware or software containing encryption may be regulated by the U.S. Department of Commerce, Bureau of Industry and Security (for more information, visit www.bis.doc.gov), and controlled for import

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1.0 Introduction

This manual describes the functional, mechanical and interface specifications for the following:
Seagate® Desktop HDD model drives:

Standard models		Self-Encryption models
ST3000DM001	ST750DM003	ST3000DM002
ST2000DM001	ST500DM002	ST2000DM002
ST1500DM003	ST320DM000	ST1000DM004
ST1000DM003	ST250DM000	

Previous generations of Seagate Self-Encrypting Drive models were called Full Disk Encryption (FDE) models before a differentiation between drive-based encryption and other forms of encryption was necessary.

These drives provide the following key features:

- 7200 RPM spindle speed.
- High instantaneous (burst) data-transfer rates (up to 600MB per second).
- TGMR recording technology provides the drives with increased areal density.
- State-of-the-art cache and on-the-fly error-correction algorithms.
- Native Command Queuing with command ordering to increase performance in demanding applications.
- Full-track multiple-sector transfer capability without local processor intervention.
- Seagate AcuTrac™ servo technology delivers dependable performance, even with hard drive track widths of only 75 nanometers.
- Seagate OptiCache™ technology boosts overall performance by as much as 45% over the previous generation.
- Seagate SmartAlign™ technology provides a simple, transparent migration to Advanced Format 4K sectors
- Quiet operation.
- Compliant with RoHS requirements in China and Europe.
- SeaTools diagnostic software performs a drive self-test that eliminates unnecessary drive returns.
- Support for S.M.A.R.T. drive monitoring and reporting.
- Supports latching SATA cables and connectors.
- Worldwide Name (WWN) capability uniquely identifies the drive.

1.1 About the SATA interface

The Serial ATA (SATA) interface provides several advantages over the traditional (parallel) ATA interface. The primary advantages include:

- Easy installation and configuration with true plug-and-play connectivity. It is not necessary to set any jumpers or other configuration options.
- Thinner and more flexible cabling for improved enclosure airflow and ease of installation.
- Scalability to higher performance levels.

In addition, SATA makes the transition from parallel ATA easy by providing legacy software support. SATA was designed to allow users to install a SATA host adapter and SATA disk drive in the current system and expect all of the existing applications to work as normal.

The SATA interface connects each disk drive in a point-to-point configuration with the SATA host adapter. There is no master/slave relationship with SATA devices like there is with parallel ATA. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. This essentially means both drives behave as if they are Device 0 (master) devices.

The SATA host adapter and drive share the function of emulating parallel ATA device behavior to provide backward compatibility with existing host systems and software. The Command and Control Block registers, PIO and DMA data transfers, resets, and interrupts are all emulated.

The SATA host adapter contains a set of registers that shadow the contents of the traditional device registers, referred to as the Shadow Register Block. All SATA devices behave like Device 0 devices. For additional information about how SATA emulates parallel ATA, refer to the “Serial ATA International Organization: Serial ATA Revision 3.0”. The specification can be downloaded from www.sata-io.org.



The host adapter may, optionally, emulate a master/slave environment to host software where two devices on separate SATA ports are represented to host software as a Device 0 (master) and Device 1 (slave) accessed at the same set of host bus addresses. A host adapter that emulates a master/slave environment manages two sets of shadow registers. This is not a typical SATA environment.

2.0 Drive Specifications

Unless otherwise noted, all specifications are measured under ambient conditions, at 25°C, and nominal power. For convenience, the phrases *the drive* and *this drive* are used throughout this manual to indicate the following drive models:

Standard models		Self-Encryption models
ST3000DM001	ST750DM003	ST3000DM002
ST2000DM001	ST500DM002	ST2000DM002
ST1500DM003	ST320DM000	ST1000DM004
ST1000DM003	ST250DM000	

2.1 Specification summary tables

The specifications listed in **Table 1** and **Table 2** are for quick reference. For details on specification measurement or definition, refer to the appropriate section of this manual.

Table 1 Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models

Drive Specification*	ST3000DM001 & ST3000DM002; ST2000DM001	ST2000DM001 & ST2000DM002; ST1500DM003	ST1000DM003 & ST1000DM004; ST750DM003
Formatted capacity (512 bytes/sector)**	3000GB (3TB); 2000GB (2TB)	2000GB (2TB); 1500GB (1.5TB)	1000GB (1TB); 750GB
Guaranteed sectors	5,860,533,168; 3,907,029,168	3,907,029,168; 2,930,277,168	1,953,525,168; 1,465,149,168
Heads	6	4	2
Disks	3	2	1
Bytes per sector (4K physical emulated at 512-byte sectors)	4096		
Default sectors per track	63		
Default read/write heads	16		
Default cylinders	16,383		
Recording density (max)	1807kFCI		
Track density (avg)	352ktracks/in		
Areal density (avg)	625Gb/in ²		
Spindle speed	7200 RPM		
Internal data transfer rate (max)	2147Mb/s		
Average data rate, read/write (MB/s)	156MB/s		
Maximum sustained data rate, OD read (MB/s)	210MB/s		
I/O data-transfer rate (max)	600MB/s		
Cache buffer	64MB		
Height (max)	26.1mm / 1.028 in		19.98mm / 0.787 in
Width (max)	101.6mm / 4.0 in (± 0.010 in)		101.6mm / 4.0 in (± 0.010 in)
Length (max)	146.99mm / 5.787 in		146.99mm / 5.787 in
Weight (typical)	626g / 1.38 lb	535g / 1.18 lb	400g / 0.88 lb
Average latency	4.16ms		
Power-on to ready (max)	<17.0s		<10.0s
Power-on to ready, 2.5A spin-up code option (typical)	<10.0s		n/a
Standby to ready (max)	<17.0s		<10.0s
Average seek, read (typical)	<8.5ms typical		
Average seek, write (typical)	<9.5ms typical		
Startup current 12V	2.0A or 2.8A		2.0A

Table 1 Drive specifications summary for 3TB, 2TB, 1.5TB, 1TB and 750GB models (continued)

Drive Specification*	ST3000DM001 & ST3000DM002; ST2000DM001	ST2000DM001 & ST2000DM002; ST1500DM003	ST1000DM003 & ST1000DM004; ST750DM003
Voltage tolerance (including noise)	5V: $\pm 5\%$ 12V: $+10\%$ / -7.5%		
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)		
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)		
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)		
Relative humidity gradient (max)	30% per hour		
Wet bulb temperature (max)	37.7°C max (operating) 40.0°C max (non-operating)		
Altitude, operating	-304.8m to 3048m (-1000 ft to 10,000+ ft)		
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)		
Operational shock (max)	80 Gs at 2ms		
Non-operational shock (max)	300 Gs at 2ms		350 Gs at 2ms
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power Idle***	2.4 bels (typical) 2.6 bels (max)		2.2 bels (typical) 2.4 bels (max)
Seek	2.6 bels (typical) 2.7 bels (max)		2.4 bels (typical) 2.5 bels (max)
Non-recoverable read errors	1 per 10^{14} bits read		
Annualized Failure Rate (AFR)	<1.0% based on 2400 POH		
Maximum Rated workload	Maximum rate of <55TB/year Workloads exceeding the annualized rate may impact product reliability. The Annualized Workload Rate is in units of TB per year, or TB per 2400 power on hours. Workload Rate = TB transferred * (2400 / recorded power on hours).		
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: http://www.seagate.com/support/warranty-and-replacements/ . From this page, click on "Check to see if the drive is under Warranty". Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.		
Load/Unload cycles (25°C, 50% rel. humidity)	300,000		
Supports Hotplug operation per the Serial ATA Revision 3.2 specification	Yes		

*All specifications above are based on native configurations.

** One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

*** During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

Table 2 Drive specifications summary for 500GB, 320GB and 250GB models

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Formatted capacity**	500GB	320GB	250GB
Guaranteed sectors	976,773,168	625,142,448	488,397,168
Heads	2		1
Disks	1		
Bytes per sector (4K physical emulated at 512-byte sectors)	4096		
Default sectors per track	63		
Default read/write heads	16		
Default cylinders	16,383		
Recording density (max)	1413kb/in		
Track density (avg)	236ktracks/in		
Areal density (avg)	329Gb/in ²		
Spindle speed	7200 RPM		
Internal data transfer rate (max)	1695Mb/s		
Average Data Rate, read/write (MB/s)	125MB/s		
Maximum sustained data transfer rate, OD read	144MB/s		
I/O data-transfer rate (max.)	600MB/s		
Cache buffer	16MB		
Height (max)	19.98mm / 0.787 in		
Width (max)	101.6mm / 4.0 in (± 0.010 in)		
Length (max)	146.99mm / 5.787 in		
Weight (typical)	415g / 0.915 lb		
Average latency	4.16ms		
Power-on to ready (max)	<8.5s		
Standby to ready (max)	<8.5s		
Average seek, read (typical)	<8.5ms (read)		
Average seek, write (typical)	<9.5ms (write)		
Startup current (typical) 12V	2.0A		
Voltage tolerance (including noise)	5V: ±5% 12V: +10% / -7.5%		
Ambient temperature	0° to 60°C (operating) -40° to 70°C (non-operating)		
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)		
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)		
Relative humidity gradient (max)	30% per hour		
Wet bulb temperature (max)	37.7°C (operating) 40.0°C (non-operating)		
Altitude, operating	-304.8m to 3048m (-1000 ft to 10,000+ ft)		
Altitude, non-operating (below mean sea level, max)	-304.8m to 12,192m (-1000 ft to 40,000+ ft)		
Operational shock (max)	70 Gs at 2ms		
Non-operational shock (max)	350 Gs at 2ms		
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power			

Table 2 Drive specifications summary for 500GB, 320GB and 250GB models (continued)

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Idle***		2.2 bels (typical) 2.3 bels (max)	
Seek		2.3 bels (typical) 2.4 bels (max)	
Non-recoverable read errors	1 per 10 ¹⁴ bits read		
Annualized Failure Rate (AFR)	<1.0% based on 2400 POH		
Maximum Rated workload	Maximum rate of <55TB/year Workloads exceeding the annualized rate may impact product reliability. The Annualized Workload Rate is in units of TB per year, or TB per 2400 power on hours. Workload Rate = TB transferred * (2400 / recorded power on hours).		
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: http://www.seagate.com/support/warranty-and-replacements/ . From this page, click on "Check to see if the drive is under Warranty". Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.		
Contact start-stop cycles	50,000 at 25°C, 50% rel. humidity		
Supports Hotplug operation per the Serial ATA Revision 3.2 specification	Yes		

* All specifications above are based on native configurations.

** One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

*** During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

2.2 Formatted capacity

Model	Formatted capacity*	Guaranteed sectors	Bytes per sector
ST3000DM001 ST3000DM002	3000GB	5,860,533,168	4K
ST2000DM001 ST2000DM002	2000GB	3,907,029,168	
ST1500DM003	1500GB	2,930,277,168	
ST1000DM003 ST1000DM004	1000GB	1,953,525,168	
ST750DM003	750GB	1,465,149,168	
ST500DM002	500GB	976,773,168	
ST320DM000	320GB	625,142,448	
ST250DM000	250GB	488,397,168	

*One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

2.2.1 LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to $n-1$, where n is the number of guaranteed sectors as defined above.

See Section 5.3.1, "Identify Device command" (words 60-61 and 100-103) for additional information about 48-bit addressing support of drives with capacities over 137GB.

2.3 Default logical geometry

Cylinders: 16,383

Read/write heads: 16

Sectors per track: 63

LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to $n-1$, where n is the number of guaranteed sectors as defined above.

2.4 Recording and interface technology

Interface	SATA
Recording method	TGMR
Recording density (kFCI)	
3TB, 2TB, 1.5TB, 1TB and 750GB models	1807
500GB, 320GB and 250GB models	1413
Track density (ktracks/inch avg)	352
Areal density (Gb/in²)	
3TB, 2TB, 1.5TB, 1TB and 750GB models	625
500GB, 320GB, 250GB models	329
Spindle speed (RPM)	7200 ± 0.2%
Internal data transfer rate (Mb/s max)	2147
Maximum sustained data transfer rate, OD read (MB/s)	
3TB, 2TB, 1.5TB, 1TB and 750GB models	210
500GB, 320GB, 250GB models	144
Average data rate, read/write (MB/s)	
3TB, 2TB, 1.5TB, 1TB and 750GB models	156
500GB, 320GB, 250GB models	125
I/O data-transfer rate (MB/s max)	600

2.5 Physical characteristics

Maximum height	
3TB, 2TB and 1.5TB	26.1mm / 1.028 in
1TB, 750GB, 500GB, 320GB, 250GB	19.98mm / 0.787 in
Maximum width (all models)	101.6mm / 4.0 in (± 0.010 in)
Maximum length (all models)	146.99mm / 5.787 in
Typical weight	
3TB and 2TB	626g / 1.38 lb
1.5TB	535g / 1.18 lb
1TB and 750GB	400g / 0.88 lb
500GB, 320GB, 250GB	415g / 0.92 lb
Cache buffer	
3TB, 2TB, 1.5TB, 1TB, 750GB	64MB (64,768kb)
500GB, 320GB and 250GB	16MB (16,384kb)

2.6 Seek time

Seek measurements are taken with nominal power at 25°C ambient temperature. All times are measured using drive diagnostics. The specifications in the table below are defined as follows:

Track-to-track seek time is an average of all possible single-track seeks in both directions.

Average seek time is a true statistical random average of at least 5000 measurements of seeks between random tracks, less overhead.

Typical seek times (ms)	Read	Write
Track-to-track	1.0	1.2
Average	8.5	9.5
Average latency	4.16	

These drives are designed to consistently meet the seek times represented in this manual. Physical seeks, regardless of mode (such as track-to-track and average), are expected to meet the noted values. However, due to the manner in which these drives are formatted, benchmark tests that include command overhead or measure logical seeks may produce results that vary from these specifications.

2.7 Start/stop times

	3-disk (3TB, 2TB models)	2-disk (2TB, 1.5TB models)	1-disk (1TB, 750GB models)	1-disk (250GB, 320GB, 500GB models)
Power-on to ready (in seconds)	15 (typical) 17 (max)		10 (typical) 12 (max)	8.5 (typical) 10 (max)
Power-on to ready, 2.5A spin-up code option (in seconds, typical)	<10		n/a	
Standby to ready (in seconds)	15 (typical) 17 (max)		10 (typical) 12 (max)	8.5 (typical) 10 (max)
Ready to spindle stop (in seconds)	10 (typical) 11 (max)		10 (typical) 11 (max)	

Time-to-ready may be longer than normal if the drive power is removed without going through normal OS powerdown procedures.

2.8 Power specifications

The drive receives DC power (+5V or +12V) through a native SATA power connector. Refer to **Figure 1 on page 23**.

2.8.1 Power consumption

Power requirements for the drives are listed in **Table 3**, **Table 4**, **Table 5** and **Table 6**. Typical power measurements are based on an average of drives tested, under nominal conditions, using 5.0V and 12.0V input voltage at 25°C ambient temperature.

Spinup power

Spinup power is measured from the time of power-on to the time that the drive spindle reaches operating speed.

Read/write power and current

Read/write power is measured with the heads on track, based on a 16-sector write followed by a 32-ms delay, then a 16-sector read followed by a 32-ms delay.

Operating power and current

Operating power is measured using 40 percent random seeks, 40 percent read/write mode (1 write for each 10 reads) and 20 percent drive idle mode.

Idle mode power

Idle mode power is measured with the drive up to speed, with servo electronics active and with the heads in a random track location.

Standby mode

During Standby mode, the drive accepts commands, but the drive is not spinning, and the servo and read/write electronics are in power-down mode.

Table 3 DC power requirements (3-disk: 3TB and 2TB models)

Power dissipation (3-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0A or 2.8A
Idle2* †	5.40	0.190	0.377
Operating	8.00	0.510	0.462
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

Table 4 DC power requirements (2-disk: 2TB and 1.5TB models)

Power dissipation (2-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0A or 2.8A
Idle2* †	4.50	0.196	0.296
Operating	6.70	0.525	0.340
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

Table 5 DC power requirements (1-disk: 1TB and 750GB models)

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0
Idle2* †	3.36	0.152	0.216
Operating	5.90	0.500	0.329
Standby	0.63	0.111	0.006
Sleep	0.63	0.111	0.006

Table 6 DC power requirements (1-disk: 500, 320 and 250GB models)

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0
Perf Idle* †	4.60	0.378	0.224
Operating	6.19	0.656	0.243
Standby	0.79	0.350	0.010
Sleep	0.79	0.350	0.010

*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

†5W IDLE with DIPLM Enabled

2.8.2 Conducted noise

Input noise ripple is measured at the host system power supply across an equivalent 80-ohm resistive load on the +12 volt line or an equivalent 15-ohm resistive load on the +5 volt line.

Using 12-volt power, the drive is expected to operate with a maximum of 120 mV peak-to-peak square-wave injected noise at up to 10MHz.

Using 5-volt power, the drive is expected to operate with a maximum of 100 mV peak-to-peak square-wave injected noise at up to 10MHz.

Equivalent resistance is calculated by dividing the nominal voltage by the typical RMS read/write current.

2.8.3 Voltage tolerance

Voltage tolerance (including noise):

5V $\pm 5\%$

12V $+10\%$ / -7.5%

2.8.4 Power-management modes

The drive provides programmable power management to provide greater energy efficiency. In most systems, users can control power management through the system setup program. The drive features the following power-management modes:

Power modes	Heads	Spindle	Buffer
Active	Tracking	Rotating	Enabled
Idle	Tracking	Rotating	Enabled
Standby	Parked	Stopped	Enabled
Sleep	Parked	Stopped	Disabled

Active mode

The drive is in Active mode during the read/write and seek operations.

Idle mode

The buffer remains enabled, and the drive accepts all commands and returns to Active mode any time disk access is necessary.

Standby mode

The drive enters Standby mode when the host sends a Standby Immediate command. If the host has set the standby timer, the drive can also enter Standby mode automatically after the drive has been inactive for a specifiable length of time. The standby timer delay is established using a Standby or Idle command. In Standby mode, the drive buffer is enabled, the heads are parked and the spindle is at rest. The drive accepts all commands and returns to Active mode any time disk access is necessary.

Sleep mode

The drive enters Sleep mode after receiving a Sleep command from the host. In Sleep mode, the drive buffer is disabled, the heads are parked and the spindle is at rest. The drive leaves Sleep mode after it receives a Hard Reset or Soft Reset from the host. After receiving a reset, the drive exits Sleep mode and enters Standby mode with all current translation parameters intact.

Idle and Standby timers

Each time the drive performs an Active function (read, write or seek), the standby timer is reinitialized and begins counting down from its specified delay times to zero. If the standby timer reaches zero before any drive activity is required, the drive makes a transition to Standby mode. In both Idle and Standby mode, the drive accepts all commands and returns to Active mode when disk access is necessary.

2.9 Environmental specifications

This section provides the temperature, humidity, shock, and vibration specifications. Ambient temperature is defined as the temperature of the environment immediately surrounding the drive. Above 1000ft. (305 meters), the maximum temperature is derated linearly by 1°C every 1000 ft.

The maximum allowable drive case temperature is 60°C.
See Figures 2 & 3 for HDA case temperature measurement locations.

Refer to Section 3.4 Drive mounting for base plate measurement location.

2.9.1 Ambient temperature

Operating	0° to 60°C (32° to 140°F)
Non-operating	–40° to 70°C (–40° to 158°F)

2.9.2 Temperature gradient

Operating	20°C per hour (68°F per hour max), without condensation
Non-operating	30°C per hour (86°F per hour max)

2.9.3 Humidity

2.9.3.1 Relative humidity

Operating	5% to 95% non-condensing (30% per hour max)
Nonoperating	5% to 95% non-condensing (30% per hour max)

2.9.3.2 Wet bulb temperature

Operating	37.7°C (99.9°F max)
Non-operating	40°C (104°F max)

2.9.4 Altitude

Operating	–304.8m to 3048m (–1000 ft. to 10,000+ ft.)
Non-operating	–304.8m to 12,192m (–1000 ft. to 40,000+ ft.)

Maximum storage condition not to exceed 90 days at a wetbulb temperature of 32°C (example: 34°C / 90% RH)

2.9.5 Shock

All shock specifications assume that the drive is mounted securely with the input shock applied at the drive mounting screws. Shock may be applied in the X, Y or Z axis.

2.9.5.1 Operating shock

These drives comply with the performance levels specified in this document when subjected to a maximum operating shock of 80 Gs based on half-sine shock pulses of 2 ms during read operations. Shocks should not be repeated more than two times per second.

2.9.5.2 Non-operating shock

3TB, 2TB and 1.5TB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 300 Gs based on a non-repetitive half-sine shock pulse of 2 ms duration.

1TB, 750GB, 500GB, 320GB and 250GB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 350 Gs based on a non-repetitive half-sine shock pulse of 2-ms duration.

2.9.5.3 Operating vibration

The maximum vibration levels that the drive may experience while meeting the performance standards specified in this document are specified below.

2Hz to 22Hz	0.25 Gs (Limited displacement)
22Hz to 350Hz	0.50 Gs
350Hz to 500Hz	0.25 Gs

All vibration specifications assume that the drive is mounted securely with the input vibration applied at the drive mounting screws. Vibration may be applied in the X, Y or Z axis. Throughput may vary if improperly mounted.

2.9.6 Non-operating vibration

The maximum non-operating vibration levels that the drive may experience without incurring physical damage or degradation in performance when subsequently put into operation are specified below.

5Hz to 22Hz	3.0 Gs (Limited displacement)
22Hz to 350Hz	3.0 Gs
350Hz to 500Hz	3.0 Gs

2.10 Acoustics

Drive acoustics are measured as overall A-weighted acoustic sound power levels (no pure tones). All measurements are consistent with ISO document 7779. Sound power measurements are taken under essentially free-field conditions over a reflecting plane. For all tests, the drive is oriented with the cover facing upward.

For seek mode tests, the drive is placed in seek mode only. The number of seeks per second is defined by the following equation:

$$(\text{Number of seeks per second} = 0.4 / (\text{average latency} + \text{average access time}))$$

Table 7 Fluid Dynamic Bearing (FDB) motor acoustics

	Idle*	Seek
3 Disks (3TB, 2TB)	2.4 bels (typical) 2.6 bels (max)	2.6 bels (typical) 2.7 bels (max)
2 Disks (2TB, 1.5TB)		
1 Disk (1TB, 750GB)	2.2 bels (typical) 2.3 bels (max)	2.3 bels (typical) 2.4 bels (max)
1 Disk (500GB, 320GB, 250GB)	2.2 bels (typical) 2.4 bels (max)	2.4 bels (typical) 2.5 bels (max)

*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

2.10.1 Test for Prominent Discrete Tones (PDTs)

Seagate follows the ECMA-74 standards for measurement and identification of PDTs. An exception to this process is the use of the absolute threshold of hearing. Seagate uses this threshold curve (originated in ISO 389-7) to discern tone audibility and to compensate for the inaudible components of sound prior to computation of tone ratios according to Annex D of the ECMA-74 standards.

2.11 Electromagnetic immunity

When properly installed in a representative host system, the drive operates without errors or degradation in performance when subjected to the radio frequency (RF) environments defined in **Table 8**.

Table 8 Radio frequency environments

Test	Description	Performance level	Reference standard
Electrostatic discharge	Contact, HCP, VCP: ± 4 kV; Air: ± 8 kV	B	EN61000-4-2: 95
Radiated RF immunity	80MHz to 1,000MHz, 3 V/m, 80% AM with 1kHz sine 900MHz, 3 V/m, 50% pulse modulation @ 200Hz	A	EN61000-4-3: 96 ENV50204: 95
Electrical fast transient	± 1 kV on AC mains, ± 0.5 kV on external I/O	B	EN61000-4-4: 95
Surge immunity	± 1 kV differential, ± 2 kV common, AC mains	B	EN61000-4-5: 95
Conducted RF immunity	150kHz to 80MHz, 3 Vrms, 80% AM with 1kHz sine	A	EN61000-4-6: 97
Voltage dips, interrupts	0% open, 5 seconds 0% short, 5 seconds 40%, 0.10 seconds 70%, 0.01 seconds	C C C B	EN61000-4-11: 94

2.12 Reliability

2.12.1 Annualized Failure Rate (AFR)

The production disk drive shall achieve an annualized failure-rate of <1.0% over a 5 year service life when used in Desktop Storage field conditions as limited by the following:

- 2400 power-on-hours per year.
- Typical workload

Nonrecoverable read errors	1 per 10 ¹⁴ bits read, max
Maximum Rated Workload	Maximum rate of <55TB/year Workloads exceeding the annualized rate may impact product reliability. The Annualized Workload Rate is in units of TB per year, or TB per 2400 power on hours. Workload Rate = TB transferred * (2400 / recorded power on hours).
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: http://www.seagate.com/support/warranty-and-replacements/ . From this page, click on the "Check to see if the drive is under Warranty" link. The following are required to be provided: the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.
Preventive maintenance	None required.

2.13 Warranty

To determine the warranty for a specific drive, use a web browser to access the following web page: <http://www.seagate.com/support/warranty-and-replacements/>

From this page, click on "Check to see if the drive is under Warranty". Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.

2.14 Agency certification

2.14.1 Safety certification

These products are certified to meet the requirements of UL60950-1, CSA60950-1 and EN60950 and so marked as to the certify agency.

2.14.2 Electromagnetic compatibility

Hard drives that display the CE mark comply with the European Union (EU) requirements specified in the Electromagnetic Compatibility Directive (2004/108/EC) as put into place 20 July 2007. Testing is performed to the levels specified by the product standards for Information Technology Equipment (ITE). Emission levels are defined by EN 55022, Class B and the immunity levels are defined by EN 55024.

Drives are tested in representative end-user systems. Although CE-marked Seagate drives comply with the directives when used in the test systems, we cannot guarantee that all systems will comply with the directives. The drive is designed for operation inside a properly designed enclosure, with properly shielded I/O cable (if necessary) and terminators on all unused I/O ports. Computer manufacturers and system integrators should confirm EMC compliance and provide CE marking for their products.

Korean RRL

If these drives have the Korean Communications Commission (KCC) logo, they comply with paragraph 1 of Article 11 of the Electromagnetic Compatibility control Regulation and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Radio Research Laboratory (RRL) Communications Commission, Republic of Korea.

These drives have been tested and comply with the Electromagnetic Interference/Electromagnetic Susceptibility (EMI/EMS) for Class B products. Drives are tested in a representative, end-user system by a Korean-recognized lab.

Family name: Barracuda

Certificate number: KCC-REM-STX-Barracuda

Australian C-Tick (N176)

If these models have the C-Tick marking, they comply with the Australia/New Zealand Standard AS/NZ CISPR22 and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Australian Communication Authority (ACA).

2.14.3FCC verification

These drives are intended to be contained solely within a personal computer or similar enclosure (not attached as an external device). As such, each drive is considered to be a subassembly even when it is individually marketed to the customer. As a subassembly, no Federal Communications Commission verification or certification of the device is required.

Seagate has tested this device in enclosures as described above to ensure that the total assembly (enclosure, disk drive, motherboard, power supply, etc.) does comply with the limits for a Class B computing device, pursuant to Subpart J, Part 15 of the FCC rules. Operation with non-certified assemblies is likely to result in interference to radio and television reception.

Radio and television interference. This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception.

This equipment is designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television, which can be determined by turning the equipment on and off, users are encouraged to try one or more of the following corrective measures:

Reorient the receiving antenna.

Move the device to one side or the other of the radio or TV.

Move the device farther away from the radio or TV.

Plug the computer into a different outlet so that the receiver and computer are on different branch outlets.

If necessary, users should consult the dealer or an experienced radio/television technician for additional suggestions. Users may find helpful the following booklet prepared by the Federal Communications Commission: *How to Identify and Resolve Radio-Television Interference Problems*. This booklet is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Refer to publication number 004-000-00345-4.

2.15 Environmental protection

Seagate designs its products to meet environmental protection requirements worldwide, including regulations restricting certain chemical substances.

2.15.1 European Union Restriction of Hazardous Substances (RoHS) Directive

The European Union Restriction of Hazardous Substances (RoHS) Directive, restricts the presence of chemical substances, including Lead, Cadmium, Mercury, Hexavalent Chromium, PBB and PBDE, in electronic products, effective July 2006. This drive is manufactured with components and materials that comply with the RoHS Directive.

2.15.2 China Restriction of Hazardous Substances (RoHS) Directive 中国限制危险物品的指令

This product has an Environmental Protection Use Period (EPUP) of 20 years. The following table contains information mandated by China's "Marking Requirements for Control of Pollution Caused by Electronic Information Products" Standard.



该产品具有20年的环境保护使用周期（EPUP）。下表包含了中国“电子产品所导致的污染的控制的记号要求”所指定的信息。

Name of Parts 部件名称	Toxic or Hazardous Substances or Elements 有毒有害物质或元素					
	Lead 铅 (Pb)	Mercury 汞 (Hg)	Cadmium 镉 (Cd)	Hexavalent Chromium 六价铬 (Cr6+)	Polybrominated Diphenyl 多溴联苯 (PBB)	Polybrominated Diphenyl Ether 多溴二苯醚 (PBDE)
PCBA	X	O	O	O	O	O
HDA	X	O	O	O	O	O

"O" indicates the hazardous and toxic substance content of the part (at the homogeneous material level) is lower than the threshold defined by the China RoHS MCV Standard.

“O”表示该部件（于同类物品程度上）所含的危险和有毒物质低于中国RoHS MCV标准所定义的门槛值。

"X" indicates the hazardous and toxic substance content of the part (at the homogeneous material level) is over the threshold defined by the China RoHS MCV Standard.

“X”表示该部件（于同类物品程度上）所含的危险和有毒物质超出中国RoHS MCV标准所定义的门槛值。

2.16 Corrosive environment

Seagate electronic drive components pass accelerated corrosion testing equivalent to 10 years exposure to light industrial environments containing sulfurous gases, chlorine and nitric oxide, classes G and H per ASTM B845. However, this accelerated testing cannot duplicate every potential application environment. Users should use caution exposing any electronic components to uncontrolled chemical pollutants and corrosive chemicals as electronic drive component reliability can be affected by the installation environment. The silver, copper, nickel and gold films used in Seagate products are especially sensitive to the presence of sulfide, chloride, and nitrate contaminants. Sulfur is found to be the most damaging. In addition, electronic components should never be exposed to condensing water on the surface of the printed circuit board assembly (PCBA) or exposed to an ambient relative humidity greater than 95%. Materials used in cabinet fabrication, such as vulcanized rubber, that can outgas corrosive compounds should be minimized or eliminated. The useful life of any electronic equipment may be extended by replacing materials near circuitry with sulfide-free alternatives.

3.0 Configuring and Mounting the Drive

This section contains the specifications and instructions for configuring and mounting the drive.

3.1 Handling and static-discharge precautions

After unpacking, and before installation, the drive may be exposed to potential handling and electrostatic discharge (ESD) hazards. Observe the following standard handling and static-discharge precautions:

Caution

Before handling the drive, put on a grounded wrist strap, or ground oneself frequently by touching the metal chassis of a computer that is plugged into a grounded outlet. Wear a grounded wrist strap throughout the entire installation procedure.

Handle the drive by its edges or frame *only*.

The drive is extremely fragile—handle it with care. Do not press down on the drive top cover.

Always rest the drive on a padded, antistatic surface until mounting it in the computer.

Do not touch the connector pins or the printed circuit board.

Do not remove the factory-installed labels from the drive or cover them with additional labels. Removal voids the warranty. Some factory-installed labels contain information needed to service the drive. Other labels are used to seal out dirt and contamination.

3.2 Configuring the drive

Each drive on the SATA interface connects point-to-point with the SATA host adapter. There is no master/slave relationship because each drive is considered a master in a point-to-point relationship. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. Both drives behave as if they are Device 0 (master) devices.

SATA drives are designed for easy installation. It is usually not necessary to set any jumpers on the drive for proper operation; however, if users connect the drive and receive a “drive not detected” error, the SATA-equipped motherboard or host adapter may use a chipset that does not support SATA speed autonegotiation.

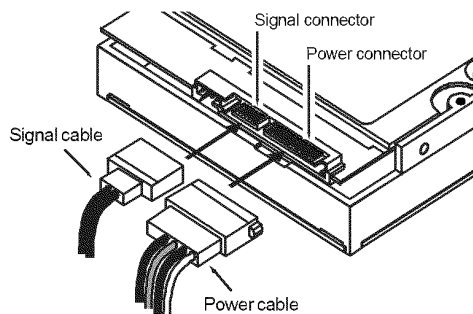
3.3 SATA cables and connectors

The SATA interface cable consists of four conductors in two differential pairs, plus three ground connections. The cable size may be 30 to 26 AWG with a maximum length of one meter (39.37 inches). See **Table 9** for connector pin definitions. Either end of the SATA signal cable can be attached to the drive or host.

For direct backplane connection, the drive connectors are inserted directly into the host receptacle. The drive and the host receptacle incorporate features that enable the direct connection to be hot pluggable and blind mateable.

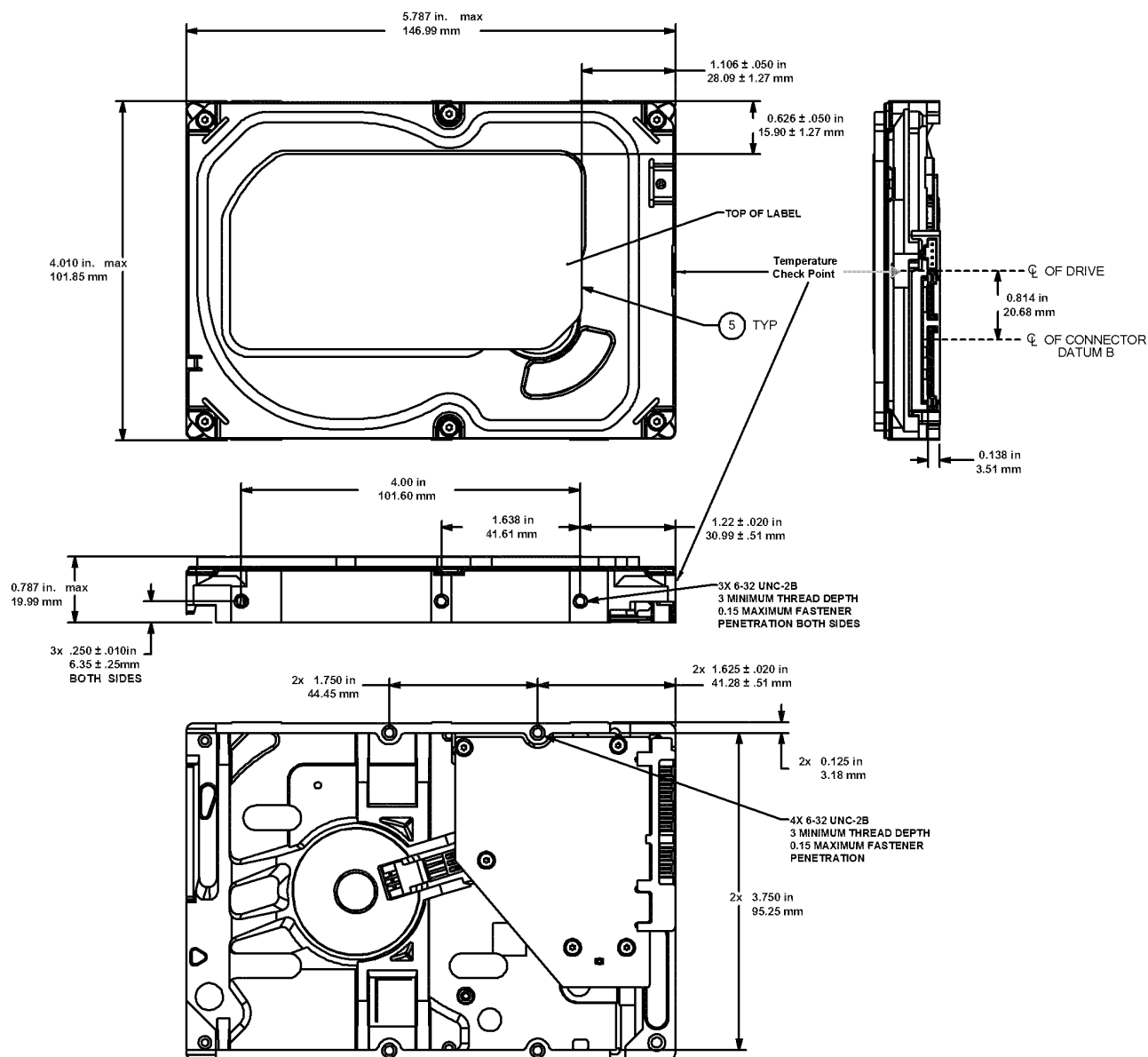
For installations which require cables, users can connect the drive as illustrated in **Figure 1**.

Figure 1 Attaching SATA cabling



Each cable is keyed to ensure correct orientation. Desktop HDD drives support latching SATA connectors.

Figure 3 Mounting dimensions (1-disk: 250GB to 1TB models)



Drawings are for mounting hole reference only.
PCBA show in pictorial only and can vary based on specific customer configurations.

4.0 About (SED) Self-Encrypting Drives

Self-encrypting drives (SEDs) offer encryption and security services for the protection of stored data, commonly known as "data at rest". These drives are compliant with the Trusted Computing Group (TCG) Opal Storage Specifications as detailed in the following:

TCG Storage Architecture Core Specification, Version 2.0 (see www.trustedcomputinggroup.org)

TCG Storage Security Subsystem Class Opal Specification, Version 2.0 (see www.trustedcomputinggroup.org)

In case of conflict between this document and any referenced document, this document takes precedence.

The Trusted Computing Group (TCG) is a standards organization sponsored and operated by companies in the computer, storage and digital communications industry. Seagate's SED models comply with the standards published by the TCG.

To use the security features in the drive, the host must be capable of constructing and issuing the following two SATA commands:

Trusted Send

Trusted Receive

These commands are used to convey the TCG protocol to and from the drive in their command payloads. Seagate Secure SEDs also support TCG Single User Mode, which can be disabled.

4.1 Data Encryption

Encrypting drives use one inline encryption engine within each drive employing AES-256 algorithms in Cipher Block Chaining (CBC) mode to encrypt all data prior to being written on the media and to decrypt all data as it is read from the media. The encryption engine is always in operation and cannot be disabled. The 32-byte Data Encryption Key (DEK) is a random number which is generated by the drive, never leaves the drive, and is inaccessible to the host system. The DEK is itself encrypted when it is stored on the media and when in volatile temporary storage (DRAM), which is external to the encryption engine. A unique data encryption key is used for each of the drive's possible 16 data bands (see **Section 4.5 Data Bands**).

4.2 Controlled Access

The drive has two security providers (SPs) called the "Admin SP" and the "Locking SP." These act as gatekeepers to the drive security services. Security-related commands will not be accepted unless the user provides the correct credentials to prove that they are authorized to perform the command.

4.2.1 Admin SP

The Admin SP allows the drive's owner to enable or disable firmware download operations (see **Section 4.4 Drive Locking**). Access to the Admin SP is available using the SID (Secure ID) password.

4.2.2 Locking SP

The Locking SP controls read/write access to the media and the cryptographic erase feature. Access to the Locking SP is available using the Admin or User passwords.

4.2.3 Default password

When the drive is shipped from the factory, all passwords are set to the value of MSID. This 32-byte random value can only be read by the host electronically over the interface. After receipt of the drive, it is the responsibility of the owner to use the default MSID password as the authority to change all other passwords to unique owner-specified values.

4.2.4 ATA Enhanced Security

The drive can utilize the system's BIOS through the ATASecurity API for cases that do not require password management and additional security policies.

Furthermore, the drive's ATA Security Erase Unit command shall support both Normal and Enhanced Erase modes with the following modifications/additions:

Normal Erase: Normal erase feature shall be performed by changing the Data Encryption Key (DEK) of the drive, followed by an overwrite operation that repeatedly writes a single sector containing random data to the entire drive. This write operation bypasses the media encryption. On reading back the overwritten sectors, the host will receive a decrypted version, using the new DEK of the random data sector (the returned data will not match what was written).

Enhanced Erase: Enhanced erase shall be performed by changing the Data Encryption Key of the drive.

4.3 Random Number Generator (RNG)

The drive has a 32-byte hardware RNG that it uses to derive encryption keys or, if requested to do so, to provide random numbers to the host for system use, including using these numbers as Authentication Keys (passwords) for the drive's Admin and Locking SPs.

4.4 Drive Locking

In addition to changing the passwords, as described in **Section 4.2.3 Default password**, the owner should also set the data access controls for the individual bands.

The variable "LockOnReset" should be set to "PowerCycle" to ensure that the data bands will be locked if power is lost. In addition "ReadLockEnabled" and "WriteLockEnabled" must be set to true in the locking table in order for the bands "LockOnReset" setting of "PowerCycle" to actually lock access to the band when a "PowerCycle" event occurs. This scenario occurs if the drive is removed from its cabinet. The drive will not honor any data read or write requests until the bands have been unlocked. This prevents the user data from being accessed without the appropriate credentials when the drive has been removed from its cabinet and installed in another system.

4.5 Data Bands

When shipped from the factory, the drive is configured with a single data band called Band 0 (also known as the Global Data Band) which comprises LBA 0 through LBA max. The host may allocate additional bands (Band1 to Band15) by specifying a start LBA and an LBA range. The real estate for this band is taken from the Global Band.

Data bands cannot overlap but they can be sequential with one band ending at LBA (x) and the next beginning at LBA (x+1).

Each data band has its own drive-generated encryption key. The host may change the Encryption Key (see **Section 4.6 Cryptographic Erase**) or the password when required.

4.6 Cryptographic Erase

A valuable feature of SEDs is the ability to perform a cryptographic erase. This involves the host telling the drive to change the data encryption key for a particular band. Once changed, the data is no longer recoverable since it was written with one key and will be read using a different key. Since the drive overwrites the old key with the new one, and keeps no history of key the older key, the user data can never be recovered. This is done in a matter of seconds and is very useful if the drive is to be scrapped or repurposed.

4.7 Authenticated Firmware Download

In addition to providing a locking mechanism to prevent unwanted firmware download attempts, the drive also only accepts download files which have been cryptographically signed by the appropriate Seagate Design Center.

Three conditions must be met before the drive will allow the download operation:

1. The download must be an SED file. A standard drive (non-SED) file will be rejected.
2. The download file must be signed and authenticated.
3. As with a non-SED drive, the download file must pass the acceptance criteria for the drive. For example it must be applicable to the correct drive model, and have compatible revision and customer status.

4.8 Power Requirements

The standard drive models and the SED drive models have identical hardware, however the security and encryption portion of the drive controller ASIC is enabled and functional in the SED models. This represents a small additional drain on the 5V supply of about

30mA and a commensurate increase of about 150mW in power consumption. There is no additional drain on the 12V supply. See the tables in **Section 2.8 Power specifications** for power requirements on the standard (non-SED) drive models.

4.9 Supported Commands

The SED models support the following two commands in addition to the commands supported by the standard (non-SED) models as listed in **Table 10**:

Trusted Send
Trusted Receive

4.10 RevertSP

SED models will support the RevertSP feature which erases all data in all bands on the device and returns the contents of all SPs (Security Providers) on the device to their original factory state. In order to execute the RevertSP method the unique PSID (Physical Secure ID) printed on the drive label must be provided. PSID is not electronically accessible and can only be manually read from the drive label or scanned in via the 2D barcode.

5.0 SATA Interface

These drives use the industry-standard Serial ATA (SATA) interface that supports FIS data transfers. It supports ATA programmed input/output (PIO) modes 0 to 4; multiword DMA modes 0 to 2, and Ultra DMA modes 0 to 6.

For detailed information about the SATA interface, refer to the “Serial ATA: High Speed Serialized AT Attachment” specification.

5.1 Hot-Plug compatibility

Desktop HDD drives incorporate connectors which enable users to hot plug these drives in accordance with the SATA Revision 3.2 specification. This specification can be downloaded from www.serialata.org.

5.2 SATA device plug connector pin definitions

Table 9 summarizes the signals on the SATA interface and power connectors.

Table 9 SATA connector pin definitions

Segment	Pin	Function	Definition
Signal	S1	Ground	2nd mate
	S2	A+	Differential signal pair A from Phy
	S3	A-	
	S4	Ground	2nd mate
	S5	B-	Differential signal pair B from Phy
	S6	B+	
	S7	Ground	2nd mate
Key and spacing separate signal and power segments			
Power	P1	V ₃₃	3.3V power
	P2	V ₃₃	3.3V power
	P3	V ₃₃	3.3V power, pre-charge, 2nd mate
	P4	Ground	1st mate
	P5	Ground	2nd mate
	P6	Ground	2nd mate
	P7	V ₅	5V power, pre-charge, 2nd mate
	P8	V ₅	5V power
	P9	V ₅	5V power
	P10	Ground	2nd mate
	P11	Ground or LED signal	If grounded, drive does not use deferred spin
	P12	Ground	1st mate.
	P13	V ₁₂	12V power, pre-charge, 2nd mate
	P14	V ₁₂	12V power
	P15	V ₁₂	12V power

Notes

- All pins are in a single row, with a 1.27 mm (0.050 in) pitch.
- The comments on the mating sequence apply to the case of backplane blindmate connector only. In this case, the mating sequences are:
 - the ground pins P4 and P12.
 - the pre-charge power pins and the other ground pins.
 - the signal pins and the rest of the power pins.
- There are three power pins for each voltage. One pin from each voltage is used for pre-charge when installed in a blind-mate backplane configuration.
 - All used voltage pins (V_x) must be terminated.

5.3 Supported ATA commands

The following table lists SATA standard commands that the drive supports.

For a detailed description of the ATA commands, refer to the Serial ATA International Organization: Serial ATA Revision 3.0 (<http://www.sata-io.org>).

See “S.M.A.R.T. commands” on page 36 for details and subcommands used in the S.M.A.R.T. implementation.

Table 10 SATA standard commands

Command name	Command code (in hex)
Check Power Mode	E5 _H
Device Configuration Freeze Lock	B1 _H / C1 _H
Device Configuration Identify	B1 _H / C2 _H
Device Configuration Restore	B1 _H / C0 _H
Device Configuration Set	B1 _H / C3 _H
Device Reset	08 _H
Download Microcode	92 _H
Execute Device Diagnostics	90 _H
Flush Cache	E7 _H
Flush Cache Extended	EA _H
Format Track	50 _H
Identify Device	EC _H
Idle	E3 _H
Idle Immediate	E1 _H
Initialize Device Parameters	91 _H
Read Buffer	E4 _H
Read DMA	C8 _H
Read DMA Extended	25 _H
Read DMA Without Retries	C9 _H
Read Log Ext	2F _H
Read Multiple	C4 _H
Read Multiple Extended	29 _H
Read Native Max Address	F8 _H
Read Native Max Address Extended	27 _H
Read Sectors	20 _H
Read Sectors Extended	24 _H
Read Sectors Without Retries	21 _H
Read Verify Sectors	40 _H
Read Verify Sectors Extended	42 _H
Read Verify Sectors Without Retries	41 _H
Recalibrate	10 _H
Security Disable Password	F6 _H
Security Erase Prepare	F3 _H
Security Erase Unit	F4 _H

Table 10 SATA standard commands (continued)

Command name	Command code (in hex)	
Security Freeze	F5 _H	
Security Set Password	F1 _H	
Security Unlock	F2 _H	
Seek	70 _H	
Set Features	EF _H	
Set Max Address	F9 _H	
Note: Individual Set Max Address commands are identified by the value placed in the Set Max Features register as defined to the right.	Address: Password: Lock: Unlock: Freeze Lock:	00 _H 01 _H 02 _H 03 _H 04 _H
Set Max Address Extended	37 _H	
Set Multiple Mode	C6 _H	
Sleep	E6 _H	
S.M.A.R.T. Disable Operations	B0 _H / D9 _H	
S.M.A.R.T. Enable/Disable Autosave	B0 _H / D2 _H	
S.M.A.R.T. Enable Operations	B0 _H / D8 _H	
S.M.A.R.T. Execute Offline	B0 _H / D4 _H	
S.M.A.R.T. Read Attribute Thresholds	B0 _H / D1 _H	
S.M.A.R.T. Read Data	B0 _H / D0 _H	
S.M.A.R.T. Read Log Sector	B0 _H / D5 _H	
S.M.A.R.T. Return Status	B0 _H / DA _H	
S.M.A.R.T. Save Attribute Values	B0 _H / D3 _H	
S.M.A.R.T. Write Log Sector	B0 _H / D6 _H	
Standby	E2 _H	
Standby Immediate	E0 _H	
Write Buffer	E8 _H	
Write DMA	CA _H	
Write DMA Extended	35 _H	
Write DMA FUA Extended	3D _H	
Write DMA Without Retries	CB _H	
Write Log Extended	3F _H	
Write Multiple	C5 _H	
Write Multiple Extended	39 _H	
Write Multiple FUA Extended	CE _H	
Write Sectors	30 _H	
Write Sectors Without Retries	31 _H	
Write Sectors Extended	34 _H	
Write Uncorrectable	45 _H	

5.3.1 Identify Device command

The Identify Device command (command code EC_H) transfers information about the drive to the host following power up. The data is organized as a single 512-byte block of data, whose contents are shown in on page 29. All reserved bits or words should be set to zero. Parameters listed with an “x” are drive-specific or vary with the state of the drive.

The following commands contain drive-specific features that may not be included in the SATA specification.

Table 11 Identify Device commands

Word	Description	Value
0	Configuration information: Bit 15: 0 = ATA; 1 = ATAPI Bit 7: removable media Bit 6: removable controller Bit 0: reserved	0C5A _H
1	Number of logical cylinders	16,383
2	ATA-reserved	0000 _H
3	Number of logical heads	16
4	Retired	0000 _H
5	Retired	0000 _H
6	Number of logical sectors per logical track: 63	003F _H
7–9	Retired	0000 _H
10–19	Serial number: (20 ASCII characters, 0000 _H = none)	ASCII
20	Retired	0000 _H
21	Retired	0400 _H
22	Obsolete	0000 _H
23–26	Firmware revision (8 ASCII character string, padded with blanks to end of string)	x.xx
27–46	Drive model number: (40 ASCII characters, padded with blanks to end of string)	
47	(Bits 7–0) Maximum sectors per interrupt on Read multiple and Write multiple (16)	8010 _H
48	Reserved	0000 _H
49	Standard Standby timer, IORDY supported and may be disabled	2F00 _H
50	ATA-reserved	0000 _H
51	PIO data-transfer cycle timing mode	0200 _H
52	Retired	0200 _H
53	Words 54–58, 64–70 and 88 are valid	0007 _H
54	Number of current logical cylinders	xxxx _H
55	Number of current logical heads	xxxx _H
56	Number of current logical sectors per logical track	xxxx _H
57–58	Current capacity in sectors	xxxx _H

Table 11 Identify Device commands (continued)

Word	Description	Value
59	Number of sectors transferred during a Read Multiple or Write Multiple command	xxxx _H
60–61	Total number of user-addressable LBA sectors available (see Section 2.2 for related information) *Note: The maximum value allowed in this field is: 0FFFFFFF _H (268,435,455 sectors, 137GB). Drives with capacities over 137GB will have 0FFFFFFF _H in this field and the actual number of user-addressable LBAs specified in words 100–103. This is required for drives that support the 48-bit addressing feature.	0FFFFFFF _H *
62	Retired	0000 _H
63	Multiword DMA active and modes supported (see note following this table)	xx07 _H
64	Advanced PIO modes supported (modes 3 and 4 supported)	0003 _H
65	Minimum multiword DMA transfer cycle time per word (120 nsec)	0078 _H
66	Recommended multiword DMA transfer cycle time per word (120 nsec)	0078 _H
67	Minimum PIO cycle time without IORDY flow control (240 nsec)	0078 _H
68	Minimum PIO cycle time with IORDY flow control (120 nsec)	0078 _H
69–74	ATA-reserved	0000 _H
75	Queue depth	001F _H
76	SATA capabilities	xxxx _H
77	Reserved for future SATA definition	xxxx _H
78	SATA features supported	xxxx _H
79	SATA features enabled	xxxx _H
80	Major version number	01F0 _H
81	Minor version number	0028 _H
82	Command sets supported	364B _H
83	Command sets supported	7F09 _H
84	Command sets support extension (see note following this table)	4163 _H
85	Command sets enabled	30xx _H
86	Command sets enabled	BE09 _H
87	Command sets enable extension	4163 _H
88	Ultra DMA support and current mode (see note following this table)	xx7F _H
89	Security erase time	0039 _H
90	Enhanced security erase time	0039 _H
92	Master password revision code	FFFE _H
93	Hardware reset value	xxxx _H
94	Automatic acoustic management	8080 _H
95–99	ATA-reserved	0000 _H

Table 11 Identify Device commands (continued)

Word	Description	Value
100–103	Total number of user-addressable LBA sectors available (see Section 2.2 for related information). These words are required for drives that support the 48-bit addressing feature. Maximum value: 0000FFFFFFFFH.	ST3000DM001 = 5,860,533,168 ST3000DM002 = 5,860,533,168 ST2000DM001 = 3,907,029,168 ST2000DM002 = 3,907,029,168 ST1500DM003 = 2,930,277,168 ST1000DM003 = 1,953,525,168 ST1000DM004 = 1,953,525,168 ST750DM003 = 1,465,149,168 ST500DM002 = 976,773,168 ST320DM000 = 625,142,448 ST250DM000 = 488,397,168
104–107	ATA-reserved	0000 _H
108–111	The mandatory value of the world wide name (WWN) for the drive. NOTE: This field is valid if word 84, bit 8 is set to 1 indicating 64-bit WWN support.	Each drive will have a unique value.
112–127	ATA-reserved	0000 _H
128	Security status	0001 _H
129–159	Seagate-reserved	xxxx _H
160–254	ATA-reserved	0000 _H
255	Integrity word	xxA5 _H

Advanced Power Management (APM) and Automatic Acoustic Management (AAM) features are not supported.

See the bit descriptions below for words 63, 84, and 88 of the Identify Drive data.

Description (if bit is set to 1)		
	Bit	Word 63
	0	Multiword DMA mode 0 is supported.
	1	Multiword DMA mode 1 is supported.
	2	Multiword DMA mode 2 is supported.
	8	Multiword DMA mode 0 is currently active.
	9	Multiword DMA mode 1 is currently active.
	10	Multiword DMA mode 2 is currently active.
	Bit	Word 84
	0	SMART error login is supported.
	1	SMART self-test is supported.
	2	Media serial number is supported.
	3	Media Card Pass Through Command feature set is supported.
	4	Streaming feature set is supported.
	5	GPL feature set is supported.

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SATA Interface

	6	WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands are supported.
	7	WRITE DMA QUEUED FUA EXT command is supported.
	8	64-bit World Wide Name is supported.
	9-10	Obsolete.
	11-12	Reserved for TLC.
	13	IDLE IMMEDIATE command with IUNLOAD feature is supported.
	14	Shall be set to 1.
	15	Shall be cleared to 0.
	Bit	Word 88
	0	Ultra DMA mode 0 is supported.
	1	Ultra DMA mode 1 is supported.
	2	Ultra DMA mode 2 is supported.
	3	Ultra DMA mode 3 is supported.
	4	Ultra DMA mode 4 is supported.
	5	Ultra DMA mode 5 is supported.
	6	Ultra DMA mode 6 is supported.
	8	Ultra DMA mode 0 is currently active.
	9	Ultra DMA mode 1 is currently active.
	10	Ultra DMA mode 2 is currently active.
	11	Ultra DMA mode 3 is currently active.
	12	Ultra DMA mode 4 is currently active.
	13	Ultra DMA mode 5 is currently active.
	14	Ultra DMA mode 6 is currently active.

5.3.2 Set Features command

This command controls the implementation of various features that the drive supports. When the drive receives this command, it sets BSY, checks the contents of the Features register, clears BSY and generates an interrupt. If the value in the register does not represent a feature that the drive supports, the command is aborted. Power-on default has the read look-ahead and write caching features enabled. The acceptable values for the Features register are defined as follows:

Table 12 Set Features command

02 _H	Enable write cache (<i>default</i>).
03 _H	Set transfer mode (based on value in Sector Count register). Sector Count register values:
00 _H	Set PIO mode to default (PIO mode 2).
01 _H	Set PIO mode to default and disable IORDY (PIO mode 2).
08 _H	PIO mode 0
09 _H	PIO mode 1
0A _H	PIO mode 2
0B _H	PIO mode 3
0C _H	PIO mode 4 (<i>default</i>)
20 _H	Multiword DMA mode 0
21 _H	Multiword DMA mode 1
22 _H	Multiword DMA mode 2
40 _H	Ultra DMA mode 0
41 _H	Ultra DMA mode 1
42 _H	Ultra DMA mode 2
43 _H	Ultra DMA mode 3
44 _H	Ultra DMA mode 4
45 _H	Ultra DMA mode 5
46 _H	Ultra DMA mode 6
10 _H	Enable use of SATA features
55 _H	Disable read look-ahead (read cache) feature.
82 _H	Disable write cache
90 _H	Disable use of SATA features
AA _H	Enable read look-ahead (read cache) feature (<i>default</i>).
F1 _H	Report full capacity available

At power-on, or after a hardware or software reset, the default values of the features are as indicated above.

5.3.3 S.M.A.R.T. commands

S.M.A.R.T. provides near-term failure prediction for disk drives. When S.M.A.R.T. is enabled, the drive monitors predetermined drive attributes that are susceptible to degradation over time. If self-monitoring determines that a failure is likely, S.M.A.R.T. makes a status report available to the host. Not all failures are predictable. S.M.A.R.T. predictability is limited to the attributes the drive can monitor. For more information on S.M.A.R.T. commands and implementation, see the *Draft ATA-5 Standard*.

SeaTools diagnostic software activates a built-in drive self-test (DST S.M.A.R.T. command for D4_H) that eliminates unnecessary drive returns. The diagnostic software ships with all new drives and is also available at: <http://seatools.seagate.com>.

This drive is shipped with S.M.A.R.T. features disabled. Users must have a recent BIOS or software package that supports S.M.A.R.T. to enable this feature. The table below shows the S.M.A.R.T. command codes that the drive uses.

Table 13 S.M.A.R.T. commands

Code in features register	S.M.A.R.T. command
D0 _H	S.M.A.R.T. Read Data
D2 _H	S.M.A.R.T. Enable/Disable Attribute Autosave
D3 _H	S.M.A.R.T. Save Attribute Values
D4 _H	S.M.A.R.T. Execute Off-line Immediate (runs DST)
D5 _H	S.M.A.R.T. Read Log Sector
D6 _H	S.M.A.R.T. Write Log Sector
D8 _H	S.M.A.R.T. Enable Operations
D9 _H	S.M.A.R.T. Disable Operations
DA _H	S.M.A.R.T. Return Status

If an appropriate code is not written to the Features Register, the command is aborted and 0x04 (abort) is written to the Error register.



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Parent_ID	SG_CTRL0037805	ORIGINAL
RecordType	IMAGE ATTACHMENT	ORIGINAL
Relativity Image Count	38	ORIGINAL
Relativity Native Time Zone Offset	-8.00	ORIGINAL
TIMECREATED	5:29 AM	ORIGINAL
TimeLastMod	11:57 AM	ORIGINAL
TITLE	untitled	ORIGINAL

EXHIBIT 56



Desktop HDD

Product Manual

Standard models

ST3000DM001
ST2000DM001
ST1000DM003
ST500DM002
ST320DM000
ST250DM000

Self-Encryption models

ST3000DM002
ST2000DM002
ST1000DM004

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Document Revision History

Revision	Date	Description of Change
Rev. A	08/19/2011	Initial release.
Rev. B	09/01/2011	Updated decibel specifications, start/stop times; Table 3; mounting drawing.
Rev. C	10/20/2011	Updated voltage tolerance specifications.
Rev. D	01/17/2012	Corrected Table 1 (Altitude, operating) specification and Table 5 (Idle2).
Rev. E	06/11/2012	Updated Index.
Rev. F	09/05/2012	Added 2.5A spin-up code option (Table 1 and Table 2); page 17.
Rev. G	10/01/2012	Updated Table 1 and Table 2 with rated workload information. Updated DC power requirements (Tables 1, 3 and 4).
Rev. H	03/21/2014	Revised Rated Workload statement (pages 5 & 7); LP height updated & new mechanical drawings (pages 4, 9 & 20-21); Revised max storage note (page 13)
Rev. J	05/08/2014	Updated product name (pages fc, 2, 19 & 22) and Add metric "mm" values to mechanical drawings. (pages 20-21).
Rev. K	08/28/2014	Add SED models and SED Section 4.0 (pages: fc, 2, 4, 7, 22-23 & 29)
Rev. L	01/26/2015	Applied new logo (pages: fc & bc), applied latest page numbering convention (pages: all), added AFR = <1.0% & update Rated Workload text (pages: 9 & 11), added Case Temp note & changed "&" to "%" in Storage note (page: 17), add Reliability Section 2.12 (page: 20), cleaned up text in Mechanical Drawings (pages: 24-25) & revised SED section 4.0 (pages: 26-27).
Rev. M	03/10/2015	Change Max Case Temperature to 69°C (page: 17)
Rev. N	08/18/2015	New cover design (page: fc) Replaced mechanical drawings to correct side hole dimension (pages: 24-25)
Rev. P	09/01/2015	Revised Rated Workload statement (pages: 9, 11 & 20)
Rev. R	02/10/2016	4: Updated Support page 8 & 13: Updated drive weight to 415g / 0.915 lb; Updated 1TB, 750GB cache = 64MB/32MB 9, 10 & 17: Revised Wet Bulb to 26/29C rated 9, 11 & 20: Revised Warranty text to "Is my Drive under Warranty" 9: 1TB, 750GB Added Contact stop/start cycles = 50,000... 10 & 13: Updated 250, 320, 500GB cache = 32MB/16MB 11: Changed Byte/sector = 4096 20: Added Section 2.12.2 Storage 21: Revised Australian C-Tick to RCM 24-25: Corrected fastener penetration depth to 0.12 in. (text & drawings)
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When referring to drive capacity, one gigabyte, or GB, equals one billion bytes and one terabyte, or TB, equals one trillion bytes. Your computer's operating system may use a different standard of measurement and report a lower capacity. In addition, some of the listed capacity is used for formatting and other functions, and thus will not be available for data storage. Actual quantities will vary based on various factors, including file size, file format, features and application software. Actual data rates may vary depending on operating environment and other factors. The export or re-export of hardware or software containing encryption may be regulated by the U.S. Department of Commerce, Bureau of Industry and Security (for more information, visit www.bis.doc.gov), and controlled for import and use outside of the U.S. Seagate reserves the right to change, without notice, product offerings or specifications.

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1.0 Introduction

This manual describes the functional, mechanical and interface specifications for the following:
Seagate® Desktop HDD model drives:

Standard models		Self-Encryption models
ST3000DM001	ST500DM002	ST3000DM002
ST2000DM001	ST320DM000	ST2000DM002
ST1000DM003	ST250DM000	ST1000DM004

Note

Previous generations of Seagate Self-Encrypting Drive models were called Full Disk Encryption (FDE) models before a differentiation between drive-based encryption and other forms of encryption was necessary.

These drives provide the following key features:

- 7200 RPM spindle speed.
- High instantaneous (burst) data-transfer rates (up to 600MB per second).
- TGM recording technology provides the drives with increased areal density.
- State-of-the-art cache and on-the-fly error-correction algorithms.
- Native Command Queuing with command ordering to increase performance in demanding applications.
- Full-track multiple-sector transfer capability without local processor intervention.
- Seagate AcuTrac™ servo technology delivers dependable performance, even with hard drive track widths of only 75 nanometers.
- Seagate OptiCache™ technology boosts overall performance by as much as 45% over the previous generation.
- Seagate SmartAlign™ technology provides a simple, transparent migration to Advanced Format 4K sectors
- Quiet operation.
- Compliant with RoHS requirements in China and Europe.
- SeaTools diagnostic software performs a drive self-test that eliminates unnecessary drive returns.
- Support for S.M.A.R.T. drive monitoring and reporting.
- Supports latching SATA cables and connectors.
- Worldwide Name (WWN) capability uniquely identifies the drive.

1.1 About the SATA interface

The Serial ATA (SATA) interface provides several advantages over the traditional (parallel) ATA interface. The primary advantages include:

- Easy installation and configuration with true plug-and-play connectivity. It is not necessary to set any jumpers or other configuration options.
- Thinner and more flexible cabling for improved enclosure airflow and ease of installation.
- Scalability to higher performance levels.

In addition, SATA makes the transition from parallel ATA easy by providing legacy software support. SATA was designed to allow users to install a SATA host adapter and SATA disk drive in the current system and expect all of the existing applications to work as normal.

The SATA interface connects each disk drive in a point-to-point configuration with the SATA host adapter. There is no master/slave relationship with SATA devices like there is with parallel ATA. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. This essentially means both drives behave as if they are Device 0 (master) devices.

The SATA host adapter and drive share the function of emulating parallel ATA device behavior to provide backward compatibility with existing host systems and software. The Command and Control Block registers, PIO and DMA data transfers, resets, and interrupts are all emulated.

The SATA host adapter contains a set of registers that shadow the contents of the traditional device registers, referred to as the Shadow Register Block. All SATA devices behave like Device 0 devices. For additional information about how SATA emulates parallel ATA, refer to the “Serial ATA International Organization: Serial ATA Revision 3.0”. The specification can be downloaded from www.sata-io.org.

Note

The host adapter may, optionally, emulate a master/slave environment to host software where two devices on separate SATA ports are represented to host software as a Device 0 (master) and Device 1 (slave) accessed at the same set of host bus addresses. A host adapter that emulates a master/slave environment manages two sets of shadow registers. This is not a typical SATA environment.

2.0 Drive Specifications

Unless otherwise noted, all specifications are measured under ambient conditions, at 25°C, and nominal power. For convenience, the phrases *the drive* and *this drive* are used throughout this manual to indicate the following drive models:

Standard models		Self-Encryption models
ST3000DM001	ST500DM002	ST3000DM002
ST2000DM001	ST320DM000	ST2000DM002
ST1000DM003	ST250DM000	ST1000DM004

2.1 Specification summary tables

The specifications listed in **Table 1** and **Table 2** are for quick reference. For details on specification measurement or definition, refer to the appropriate section of this manual.

Table 1 Drive specifications summary for 3TB, 2TB and 1TB models

Drive Specification*	ST3000DM001 & ST3000DM002	ST2000DM001 & ST2000DM002	ST1000DM003 & ST1000DM004
Formatted capacity (512 bytes/sector)**	3000GB (3TB);	2000GB (2TB);	1000GB (1TB);
Guaranteed sectors	5,860,533,168;	3,907,029,168;	1,953,525,168;
Heads	6	6 / 4	2
Disks	3	3 / 2	1
Bytes per sector (4K physical emulated at 512-byte sectors)	4096		
Default sectors per track	63		
Default read/write heads	16		
Default cylinders	16,383		
Recording density (max)	1807kFCI		
Track density (avg)	352ktracks/in		
Areal density (avg)	625Gb/in ²		
Spindle speed	7200 RPM		
Internal data transfer rate (max)	2147Mb/s		
Average data rate, read/write (MB/s)	156MB/s		
Maximum sustained data rate, OD read (MB/s)	210MB/s		
I/O data-transfer rate (max)	600MB/s		
Cache buffer	64MB		64/32 MB
Height (max)	26.1mm / 1.028 in		19.98mm / 0.787 in
Width (max)	101.6mm / 4.0 in (± 0.010 in)		101.6mm / 4.0 in (± 0.010 in)
Length (max)	146.99mm / 5.787 in		146.99mm / 5.787 in
Weight (typical)	626g / 1.38 lb	626g/1.38lb 535g / 1.18 lb	415g / 0.915 lb
Average latency	4.16ms		
Power-on to ready (max)	<17.0s		<10.0s
Power-on to ready, 2.5A spin-up code option (typical)	<10.0s		n/a
Standby to ready (max)	<17.0s		<10.0s
Average seek, read (typical)	<8.5ms		
Average seek, write (typical)	<9.5ms		
Startup current 12V	2.0A or 2.5A		2.0A
Voltage tolerance (including noise)	5V: ±5% 12V: +10% / -7.5%		
Non-Operating ambient temperature (°C)	-40° to 70		
Operating ambient temperature (min °C)	0		

Table 1 Drive specifications summary for 3TB, 2TB and 1TB models (continued)

Drive Specification*	ST3000DM001 & ST3000DM002	ST2000DM001 & ST2000DM002	ST1000DM003 & ST1000DM004
Operating temperature (Drive case max °C)	60		
Temperature gradient	20°C per hour max (operating) 30°C per hour max (non-operating)		
Relative humidity	5% to 95% (operating) 5% to 95% (non-operating)		
Relative humidity gradient (max)	30% per hour		
Wet bulb temperature (max)	26°C max (operating) 29°C max (nonoperating)		
Altitude, operating	–304.8m to 3048m (–1000 ft to 10,000+ ft)		
Altitude, non-operating (below mean sea level, max)	–304.8m to 12,192m (–1000 ft to 40,000+ ft)		
Operational shock (max)	80 Gs at 2ms		
Non-operational shock (max)	300 Gs at 2ms		350 Gs at 2ms
Vibration, operating	2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs		
Vibration, non-operating	5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs		
Drive acoustics, sound power			
Idle***	2.4 bels (typical) 2.6 bels (max)		2.2 bels (typical) 2.4 bels (max)
Seek	2.6 bels (typical) 2.7 bels (max)		2.4 bels (typical) 2.5 bels (max)
Non-recoverable read errors	1 per 10 ¹⁴ bits read		
Annualized Failure Rate (AFR)	<1.0% based on 2400 POH		
Rated Workload	Average annualized workload rating: <55 TB/year. The AFR specification for the product assumes the I/O workload does not exceed the average annualized workload rate limit of 55 TB/year. Workloads exceeding the annualized rate may degrade the product AFR and impact reliability as experienced by the particular application. The average annualized workload rate limit is in units of TB per calendar year.		
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: http://www.seagate.com/support/warranty-and-replacements/ . From this page, click on “Is my Drive under Warranty”. Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.		
Load/Unload cycles (25°C, 50% rel. humidity)	300,000		
Contact start-stop cycles	----		50,000 at 25°C, 50% rel. humidity
Supports Hotplug operation per the Serial ATA Revision 3.2 specification	Yes		

*All specifications above are based on native configurations.

** One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

*** During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

Table 2 Drive specifications summary for 500GB, 320GB and 250GB models

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Formatted capacity**	500GB	320GB	250GB
Guaranteed sectors	976,773,168	625,142,448	488,397,168
Heads		2/1	
Disks		1	
Bytes per sector (4K physical emulated at 512-byte sectors)		4096	
Default sectors per track		63	
Default read/write heads		16	
Default cylinders		16,383	
Recording density (max)		1413kb/in	
Track density (avg)		236ktracks/in	
Areal density (avg)		329Gb/in ²	
Spindle speed		7200 RPM	
Internal data transfer rate (max)		1695Mb/s	
Average Data Rate, read/write (MB/s)		125MB/s	
Maximum sustained data transfer rate, OD read		144MB/s	
I/O data-transfer rate (max.)		600MB/s	
Cache buffer		16 MB	
Height (max)		19.98mm / 0.787 in	
Width (max)		101.6mm / 4.0 in (± 0.010 in)	
Length (max)		146.99mm / 5.787 in	
Weight (typical)		415g / 0.915 lb	
Average latency		4.16ms	
Power-on to ready (max)		<8.5s	
Standby to ready (max)		<8.5s	
Average seek, read (typical)		<8.5ms	
Average seek, write (typical)		<9.5ms	
Startup current (typical) 12V		2.0A	
Voltage tolerance (including noise)		5V: $\pm 5\%$ 12V: $+10\%$ / -7.5%	
Non-Operating ambient temperature (°C)		-40° to 70	
Operating ambient temperature (min °C)		0	
Operating temperature (Drive case max °C)		60	
Temperature gradient		20°C per hour max (operating) 30°C per hour max (non-operating)	
Relative humidity		5% to 95% (operating) 5% to 95% (non-operating)	
Relative humidity gradient (max)		30% per hour	
Wet bulb temperature (max)		26°C max (operating) 29°C max (nonoperating)	
Altitude, operating		-304.8m to 3048m (-1000 ft to 10,000+ ft)	
Altitude, non-operating (below mean sea level, max)		-304.8m to 12,192m (-1000 ft to 40,000+ ft)	
Operational shock (max)		70 Gs at 2ms	
Non-operational shock (max)		350 Gs at 2ms	
Vibration, operating		2Hz to 22Hz: 0.25 Gs, Limited displacement 22Hz to 350Hz: 0.50 Gs 350Hz to 500Hz: 0.25 Gs	
Vibration, non-operating		5Hz to 22Hz: 3.0 Gs 22Hz to 350Hz: 3.0 Gs 350Hz to 500Hz: 3.0 Gs	

Table 2 Drive specifications summary for 500GB, 320GB and 250GB models (continued)

Drive Specification*	ST500DM002	ST320DM000	ST250DM000
Drive acoustics, sound power	2.2 bels (typical) 2.3 bels (max)		
Idle***			
Seek	2.3 bels (typical) 2.4 bels (max)		
Non-recoverable read errors	1 per 10 ¹⁴ bits read		
Annualized Failure Rate (AFR)	<1.0% based on 2400 POH		
Rated Workload	Average annualized workload rating: <55 TB/year. The AFR specification for the product assumes the I/O workload does not exceed the average annualized workload rate limit of 55 TB/year. Workloads exceeding the annualized rate may degrade the product AFR and impact reliability as experienced by the particular application. The average annualized workload rate limit is in units of TB per calendar year.		
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: http://www.seagate.com/support/warranty-and-replacements/ From this page, click on "Is my Drive under Warranty". Users will be asked to provide the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.		
Contact start-stop cycles	50,000 at 25°C, 50% rel. humidity		
Supports Hotplug operation per the Serial ATA Revision 3.2 specification	Yes		

* All specifications above are based on native configurations.

** One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

*** During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

2.2 Formatted capacity

Model	Formatted capacity*	Guaranteed sectors	Bytes per sector
ST3000DM001 ST3000DM002	3000GB	5,860,533,168	4096
ST2000DM001 ST2000DM002	2000GB	3,907,029,168	
ST1000DM003 ST1000DM004	1000GB	1,953,525,168	
ST500DM002	500GB	976,773,168	
ST320DM000	320GB	625,142,448	
ST250DM000	250GB	488,397,168	

*One GB equals one billion bytes and 1TB equals one trillion bytes when referring to hard drive capacity. Accessible capacity may vary depending on operating environment and formatting.

2.2.1 LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to $n-1$, where n is the number of guaranteed sectors as defined above.

See Section 5.3.1, "Identify Device command" (words 60-61 and 100-103) for additional information about 48-bit addressing support of drives with capacities over 137GB.

2.3 Default logical geometry

- **Cylinders:** 16,383
- **Read/write heads:** 16
- **Sectors per track:** 63

LBA mode

When addressing these drives in LBA mode, all blocks (sectors) are consecutively numbered from 0 to $n-1$, where n is the number of guaranteed sectors as defined above.

2.4 Recording and interface technology

Interface	SATA
Recording method	TGMR
Recording density (kFCI)	
3TB, 2TB and 1TB models	1807
500GB, 320GB and 250GB models	1413
Track density (ktracks/inch avg)	352
Areal density (Gb/in²)	
3TB, 2TB and 1TB models	625
500GB, 320GB and 250GB models	329
Spindle speed (RPM)	7200 \pm 0.2%
Internal data transfer rate (Mb/s max)	2147
Maximum sustained data transfer rate, OD read (MB/s)	
3TB, 2TB and 1TB models	210
500GB, 320GB and 250GB models	144
Average data rate, read/write (MB/s)	
3TB, 2TB and 1TB models	156
500GB, 320GB and 250GB models	125
I/O data-transfer rate (MB/s max)	600

2.5 Physical characteristics

Maximum height		
	3TB and 2TB	26.1mm / 1.028 in
	1TB, 500GB, 320GB, 250GB	19.98mm / 0.787 in
Maximum width (all models)		101.6mm / 4.0 in (± 0.010 in)
Maximum length (all models)		146.99mm / 5.787 in
Typical weight		
	3TB	626g / 1.38 lb
	2TB	626g / 1.38 lb - or - 535g / 1.18 lb
	1TB, 500GB, 320GB and 250GB	415g / 0.915 lb
Cache buffer		
	3TB, 2TB	64MB (64,768kB)
	1TB	64MB (64,768kB) / 32MB (32,768kB)
	500GB, 320GB and 250GB	16MB (16,384kB)

2.6 Seek time

Seek measurements are taken with nominal power at 25°C ambient temperature. All times are measured using drive diagnostics. The specifications in the table below are defined as follows:

- Track-to-track seek time is an average of all possible single-track seeks in both directions.
- Average seek time is a true statistical random average of at least 5000 measurements of seeks between random tracks, less overhead.

Typical seek times (ms)	Read	Write
Track-to-track	1.0	1.2
Average	8.5	9.5
Average latency	4.16	

Note

These drives are designed to consistently meet the seek times represented in this manual. Physical seeks, regardless of mode (such as track-to-track and average), are expected to meet the noted values. However, due to the manner in which these drives are formatted, benchmark tests that include command overhead or measure logical seeks may produce results that vary from these specifications.

2.7 Start/stop times

	3-disk (3TB, 2TB models)	2-disk (2TB models)	1-disk (1TB models)	1-disk (250GB, 320GB, 500GB models)
Power-on to ready (in seconds)	15 (typical) 17 (max)		10 (typical) 12 (max)	8.5 (typical) 10 (max)
Power-on to ready, 2.5A spin-up code option (in seconds, typical)	<10		n/a	
Standby to ready (in seconds)	15 (typical) 17 (max)		10 (typical) 12 (max)	8.5 (typical) 10 (max)
Ready to spindle stop (in seconds)	10 (typical) 11 (max)		10 (typical) 11 (max)	

Time-to-ready may be longer than normal if the drive power is removed without going through normal OS powerdown procedures.

2.8 Power specifications

The drive receives DC power (+5V or +12V) through a native SATA power connector. Refer to **Figure 1 on page 23**.

2.8.1 Power consumption

Power requirements for the drives are listed in **Table 3**, **Table 4**, **Table 5** and **Table 6**. Typical power measurements are based on an average of drives tested, under nominal conditions, using 5.0V and 12.0V input voltage at 25°C ambient temperature.

- **Spinup power**
Spinup power is measured from the time of power-on to the time that the drive spindle reaches operating speed.
- **Read/write power and current**
Read/write power is measured with the heads on track, based on a 16-sector write followed by a 32-ms delay, then a 16-sector read followed by a 32-ms delay.
- **Operating power and current**
Operating power is measured using 40 percent random seeks, 40 percent read/write mode (1 write for each 10 reads) and 20 percent drive idle mode.
- **Idle mode power**
Idle mode power is measured with the drive up to speed, with servo electronics active and with the heads in a random track location.
- **Standby mode**
During Standby mode, the drive accepts commands, but the drive is not spinning, and the servo and read/write electronics are in power-down mode.

Table 3 DC power requirements (3-disk: 3TB and 2TB models)

Power dissipation (3-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0A or 2.5A
Idle2* †	5.40	0.190	0.377
Operating	8.00	0.510	0.462
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

Table 4 DC power requirements (2-disk: 2TB models)

Power dissipation (2-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0A or 2.5A
Idle2* †	4.50	0.196	0.296
Operating	6.70	0.525	0.340
Standby	0.75	0.136	0.005
Sleep	0.75	0.136	0.005

Table 5 DC power requirements (1-disk: 1TB models)

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V amps
Spinup	—	—	2.0
Idle2* †	3.36	0.152	0.216
Operating	5.90	0.500	0.329
Standby	0.63	0.111	0.006
Sleep	0.63	0.111	0.006

Table 6 DC power requirements (1-disk: 500, 320 and 250GB models)

Power dissipation (1-disk values shown)	Avg (watts 25° C)	Avg 5V typ amps	Avg 12V typ amps
Spinup	—	—	2.0
Perf Idle* †	4.60	0.378	0.224
Operating	6.19	0.656	0.243
Standby	0.79	0.350	0.010
Sleep	0.79	0.350	0.010

*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

†5W IDLE with DIPLM Enabled

2.8.2 Conducted noise

Input noise ripple is measured at the host system power supply across an equivalent 80-ohm resistive load on the +12 volt line or an equivalent 15-ohm resistive load on the +5 volt line.

- Using 12-volt power, the drive is expected to operate with a maximum of 120 mV peak-to-peak square-wave injected noise at up to 10MHz.
- Using 5-volt power, the drive is expected to operate with a maximum of 100 mV peak-to-peak square-wave injected noise at up to 10MHz.

Note Equivalent resistance is calculated by dividing the nominal voltage by the typical RMS read/write current.

2.8.3 Voltage tolerance

Voltage tolerance (including noise):

- 5V \pm 5%
- 12V +10% / -7.5%

2.8.4 Power-management modes

The drive provides programmable power management to provide greater energy efficiency. In most systems, users can control power management through the system setup program. The drive features the following power-management modes:

Power modes	Heads	Spindle	Buffer
Active	Tracking	Rotating	Enabled
Idle	Tracking	Rotating	Enabled
Standby	Parked	Stopped	Enabled
Sleep	Parked	Stopped	Disabled

- **Active mode**
The drive is in Active mode during the read/write and seek operations.
- **Idle mode**
The buffer remains enabled, and the drive accepts all commands and returns to Active mode any time disk access is necessary.
- **Standby mode**
The drive enters Standby mode when the host sends a Standby Immediate command. If the host has set the standby timer, the drive can also enter Standby mode automatically after the drive has been inactive for a specifiable length of time. The standby timer delay is established using a Standby or Idle command. In Standby mode, the drive buffer is enabled, the heads are parked and the spindle is at rest. The drive accepts all commands and returns to Active mode any time disk access is necessary.
- **Sleep mode**
The drive enters Sleep mode after receiving a Sleep command from the host. In Sleep mode, the drive buffer is disabled, the heads are parked and the spindle is at rest. The drive leaves Sleep mode after it receives a Hard Reset or Soft Reset from the host. After receiving a reset, the drive exits Sleep mode and enters Standby mode with all current translation parameters intact.
- **Idle and Standby timers**
Each time the drive performs an Active function (read, write or seek), the standby timer is reinitialized and begins counting down from its specified delay times to zero. If the standby timer reaches zero before any drive activity is required, the drive makes a transition to Standby mode. In both Idle and Standby mode, the drive accepts all commands and returns to Active mode when disk access is necessary.

2.9 Environmental specifications

This section provides the temperature, humidity, shock, and vibration specifications. Ambient temperature is defined as the temperature of the environment immediately surrounding the drive. Above 1000ft. (305 meters), the maximum temperature is derated linearly by 1°C every 1000 ft.

Note

The maximum allowable drive case temperature is 60°C.
See Figures 2 & 3 for HDA case temperature measurement locations.

Refer to [Section 3.4 Drive mounting](#) for base plate measurement location.

2.9.1 Ambient temperature

Non-Operating ambient temperature (°C)	–40° to 70
Operating ambient temperature (min °C)	0
Operating temperature (Drive case max °C)	60

2.9.2 Temperature gradient

Operating	20°C per hour (68°F per hour max), without condensation
Non-operating	30°C per hour (86°F per hour max)

2.9.3 Humidity

2.9.3.1 Relative humidity

Operating	5% to 95% non-condensing (30% per hour max)
Nonoperating	5% to 95% non-condensing (30% per hour max)

2.9.3.2 Wet bulb temperature

Operating	26°C / 78.8°F (rated)
Non-operating	29°C / 84.2°F (rated)

2.9.4 Altitude

Operating	–304.8m to 3048m (–1000 ft. to 10,000+ ft.)
Non-operating	–304.8m to 12,192m (–1000 ft. to 40,000+ ft.)

2.9.5 Shock

All shock specifications assume that the drive is mounted securely with the input shock applied at the drive mounting screws. Shock may be applied in the X, Y or Z axis.

2.9.5.1 Operating shock

These drives comply with the performance levels specified in this document when subjected to a maximum operating shock of 80 Gs based on half-sine shock pulses of 2 ms during read operations. Shocks should not be repeated more than two times per second.

2.9.5.2 Non-operating shock

3TB and 2TB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 300 Gs based on a non-repetitive half-sine shock pulse of 2 ms duration.

1TB, 500GB, 320GB and 250GB models

The non-operating shock level that the drive can experience without incurring physical damage or degradation in performance when subsequently put into operation is 350 Gs based on a non-repetitive half-sine shock pulse of 2-ms duration.

2.9.5.3 Operating vibration

The maximum vibration levels that the drive may experience while meeting the performance standards specified in this document are specified below.

2Hz to 22Hz	0.25 Gs (Limited displacement)
22Hz to 350Hz	0.50 Gs
350Hz to 500Hz	0.25 Gs

All vibration specifications assume that the drive is mounted securely with the input vibration applied at the drive mounting screws. Vibration may be applied in the X, Y or Z axis. Throughput may vary if improperly mounted.

2.9.6 Non-operating vibration

The maximum non-operating vibration levels that the drive may experience without incurring physical damage or degradation in performance when subsequently put into operation are specified below.

5Hz to 22Hz	3.0 Gs (Limited displacement)
22Hz to 350Hz	3.0 Gs
350Hz to 500Hz	3.0 Gs

2.10 Acoustics

Drive acoustics are measured as overall A-weighted acoustic sound power levels (no pure tones). All measurements are consistent with ISO document 7779. Sound power measurements are taken under essentially free-field conditions over a reflecting plane. For all tests, the drive is oriented with the cover facing upward.

Note

For seek mode tests, the drive is placed in seek mode only.
The number of seeks per second is defined by the following equation:
$$(\text{Number of seeks per second} = 0.4 / (\text{average latency} + \text{average access time}))$$

Table 7 Fluid Dynamic Bearing (FDB) motor acoustics

	Idle*	Seek
3 Disks (3TB, 2TB)	2.4 bels (typical) 2.6 bels (max)	2.6 bels (typical) 2.7 bels (max)
2 Disks (2TB)		
1 Disk (1TB)	2.2 bels (typical) 2.3 bels (max)	2.3 bels (typical) 2.4 bels (max)
1 Disk (500GB, 320GB, 250GB)	2.2 bels (typical) 2.4 bels (max)	2.4 bels (typical) 2.5 bels (max)

*During periods of drive idle, some offline activity may occur according to the S.M.A.R.T. specification, which may increase acoustic and power to operational levels.

2.10.1 Test for Prominent Discrete Tones (PDTs)

Seagate follows the ECMA-74 standards for measurement and identification of PDTs. An exception to this process is the use of the absolute threshold of hearing. Seagate uses this threshold curve (originated in ISO 389-7) to discern tone audibility and to compensate for the inaudible components of sound prior to computation of tone ratios according to Annex D of the ECMA-74 standards.

2.11 Electromagnetic immunity

When properly installed in a representative host system, the drive operates without errors or degradation in performance when subjected to the radio frequency (RF) environments defined in [Table 8](#).

Table 8 Radio frequency environments

Test	Description	Performance level	Reference standard
Electrostatic discharge	Contact, HCP, VCP: ± 4 kV; Air: ± 8 kV	B	EN61000-4-2: 95
Radiated RF immunity	80MHz to 1,000MHz, 3 V/m, 80% AM with 1kHz sine 900MHz, 3 V/m, 50% pulse modulation @ 200Hz	A	EN61000-4-3: 96 ENV50204: 95
Electrical fast transient	± 1 kV on AC mains, ± 0.5 kV on external I/O	B	EN61000-4-4: 95
Surge immunity	± 1 kV differential, ± 2 kV common, AC mains	B	EN61000-4-5: 95
Conducted RF immunity	150kHz to 80MHz, 3 Vrms, 80% AM with 1kHz sine	A	EN61000-4-6: 97
Voltage dips, interrupts	0% open, 5 seconds 0% short, 5 seconds 40%, 0.10 seconds 70%, 0.01 seconds	C C C B	EN61000-4-11: 94

2.12 Reliability

2.12.1 Annualized Failure Rate (AFR)

The production disk drive shall achieve an annualized failure-rate of <1.0% over a 5 year service life when used in Desktop Storage field conditions as limited by the following:

- 2400 power-on-hours per year.
- Typical workload

Nonrecoverable read errors	1 per 10 ¹⁴ bits read, max
Rated Workload	Average annualized workload rating: <55 TB/year. The AFR specification for the product assumes the I/O workload does not exceed the average annualized workload rate limit of 55 TB/year. Workloads exceeding the annualized rate may degrade the product AFR and impact reliability as experienced by the particular application. The average annualized workload rate limit is in units of TB per calendar year.
Warranty	To determine the warranty for a specific drive, use a web browser to access the following web page: http://www.seagate.com/support/warranty-and-replacements/ . From this page, click on the "Is my Drive under Warranty" link. The following are required to be provided: the drive serial number, model number (or part number) and country of purchase. The system will display the warranty information for the drive.
Preventive maintenance	None required.

2.12.2 Storage

Maximum storage periods are 180 days within original unopened Seagate shipping package or 60 days unpackaged within the defined non-operating limits (refer to environmental section in this manual). Storage can be extended to 1 year packaged or unpackaged under optimal environmental conditions (25°C, <40% relative humidity non-condensing, and non-corrosive environment). During any storage period the drive non-operational temperature, humidity, wet bulb, atmospheric conditions, shock, vibration, magnetic and electrical field specifications should be followed.

2.13 Agency certification

2.13.1 Safety certification

These products are certified to meet the requirements of UL60950-1, CSA60950-1 and EN60950 and so marked as to the certify agency.

2.13.2 Electromagnetic compatibility

Hard drives that display the CE mark comply with the European Union (EU) requirements specified in the Electromagnetic Compatibility Directive (2004/108/EC) as put into place 20 July 2007. Testing is performed to the levels specified by the product standards for Information Technology Equipment (ITE). Emission levels are defined by EN 55022, Class B and the immunity levels are defined by EN 55024.

Drives are tested in representative end-user systems. Although CE-marked Seagate drives comply with the directives when used in the test systems, we cannot guarantee that all systems will comply with the directives. The drive is designed for operation inside a properly designed enclosure, with properly shielded I/O cable (if necessary) and terminators on all unused I/O ports. Computer manufacturers and system integrators should confirm EMC compliance and provide CE marking for their products.

Korean RRL

If these drives have the Korean Communications Commission (KCC) logo, they comply with paragraph 1 of Article 11 of the Electromagnetic Compatibility control Regulation and meet the Electromagnetic Compatibility (EMC) Framework requirements of the Radio Research Laboratory (RRL) Communications Commission, Republic of Korea.

These drives have been tested and comply with the Electromagnetic Interference/Electromagnetic Susceptibility (EMI/EMS) for Class B products. Drives are tested in a representative, end-user system by a Korean-recognized lab.

B급 기기 (가정용 정보통신기기)	이 기기는 가정용으로 전자파적합등록을한 기기로서 주거지역에서는 물론 모든지역에서 사용할 수 있습니다.
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Australian RCM Compliance Mark

Models displayed with the RCM compliance mark, comply with the mandatory standards as per the Australian Communications and Media Authority (ACMA) Electromagnetic Compatibility (EMC) regulatory arrangement.

2.13.3 FCC verification

These drives are intended to be contained solely within a personal computer or similar enclosure (not attached as an external device). As such, each drive is considered to be a subassembly even when it is individually marketed to the customer. As a subassembly, no Federal Communications Commission verification or certification of the device is required.

Seagate has tested this device in enclosures as described above to ensure that the total assembly (enclosure, disk drive, motherboard, power supply, etc.) does comply with the limits for a Class B computing device, pursuant to Subpart J, Part 15 of the FCC rules. Operation with non-certified assemblies is likely to result in interference to radio and television reception.

Radio and television interference. This equipment generates and uses radio frequency energy and if not installed and used in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception.

This equipment is designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television, which can be determined by turning the equipment on and off, users are encouraged to try one or more of the following corrective measures:

- Reorient the receiving antenna.
- Move the device to one side or the other of the radio or TV.
- Move the device farther away from the radio or TV.
- Plug the computer into a different outlet so that the receiver and computer are on different branch outlets.

If necessary, users should consult the dealer or an experienced radio/television technician for additional suggestions. Users may find helpful the following booklet prepared by the Federal Communications Commission: *How to Identify and Resolve Radio-Television Interference Problems*. This booklet is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Refer to publication number 004-000-00345-4.

2.14 Environmental protection

Seagate designs its products to meet environmental protection requirements worldwide, including regulations restricting certain chemical substances.

2.14.1 European Union Restriction of Hazardous Substances (RoHS) Directive

The European Union Restriction of Hazardous Substances (RoHS) Directive, restricts the presence of chemical substances, including Lead, Cadmium, Mercury, Hexavalent Chromium, PBB and PBDE, in electronic products, effective July 2006. This drive is manufactured with components and materials that comply with the RoHS Directive.

2.14.2 China Requirements — China RoHS 2

China RoHS 2 refers to the Ministry of Industry and Information Technology Order No. 32, effective July 1, 2016, titled Management Methods for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products. To comply with China RoHS 2, we determined this product's Environmental Protection Use Period (EPUP) to be 20 years in accordance with the *Marking for the Restricted Use of Hazardous Substances in Electronic and Electrical Products*, SJT 11364-2014.

中国电器电子产品有害物质限制使用管理办法

(Management Methods for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products _ China RoHS)

产品中有害物质的名称及含量

(Name and Content of the Hazardous Substances in Product)



Table 9 Hazardous Substances

部件名称 Part Name	有害物质 Hazardous Substances					
	铅 Lead (Pb)	汞 Mercury (Hg)	镉 Cadmium (Cd)	六价铬 Hexavalent Chromium (Cr (VI))	多溴联苯 Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)
印刷电路板组装 PCBA	X	O	O	O	O	O
机壳 Chassis	X	O	O	O	O	O
<p>本表格依据 SJ/T 11364 的规定编制。 This table is prepared in accordance with the provisions of SJ/T 11364-2014</p> <p>O: 表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 规定的限量要求以下。 O: Indicates that the hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement of GB/T26572.</p> <p>X: 表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 规定的限量要求。 X: Indicates that the hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T26572.</p>						

2.15 Corrosive environment

Seagate electronic drive components pass accelerated corrosion testing equivalent to 10 years exposure to light industrial environments containing sulfurous gases, chlorine and nitric oxide, classes G and H per ASTM B845. However, this accelerated testing cannot duplicate every potential application environment. Users should use caution exposing any electronic components to uncontrolled chemical pollutants and corrosive chemicals as electronic drive component reliability can be affected by the installation environment. The silver, copper, nickel and gold films used in Seagate products are especially sensitive to the presence of sulfide, chloride, and nitrate contaminants. Sulfur is found to be the most damaging. In addition, electronic components should never be exposed to condensing water on the surface of the printed circuit board assembly (PCBA) or exposed to an ambient relative humidity greater than 95%. Materials used in cabinet fabrication, such as vulcanized rubber, that can outgas corrosive compounds should be minimized or eliminated. The useful life of any electronic equipment may be extended by replacing materials near circuitry with sulfide-free alternatives.

3.0 Configuring and Mounting the Drive

This section contains the specifications and instructions for configuring and mounting the drive.

3.1 Handling and static-discharge precautions

After unpacking, and before installation, the drive may be exposed to potential handling and electrostatic discharge (ESD) hazards. Observe the following standard handling and static-discharge precautions:

Caution

- Before handling the drive, put on a grounded wrist strap, or ground oneself frequently by touching the metal chassis of a computer that is plugged into a grounded outlet. Wear a grounded wrist strap throughout the entire installation procedure.
- Handle the drive by its edges or frame *only*.
- The drive is extremely fragile—handle it with care. Do not press down on the drive top cover.
- Always rest the drive on a padded, antistatic surface until mounting it in the computer.
- Do not touch the connector pins or the printed circuit board.
- Do not remove the factory-installed labels from the drive or cover them with additional labels. Removal voids the warranty. Some factory-installed labels contain information needed to service the drive. Other labels are used to seal out dirt and contamination.

3.2 Configuring the drive

Each drive on the SATA interface connects point-to-point with the SATA host adapter. There is no master/slave relationship because each drive is considered a master in a point-to-point relationship. If two drives are attached on one SATA host adapter, the host operating system views the two devices as if they were both “masters” on two separate ports. Both drives behave as if they are Device 0 (master) devices.

SATA drives are designed for easy installation. It is usually not necessary to set any jumpers on the drive for proper operation; however, if users connect the drive and receive a “drive not detected” error, the SATA-equipped motherboard or host adapter may use a chipset that does not support SATA speed autonegotiation.

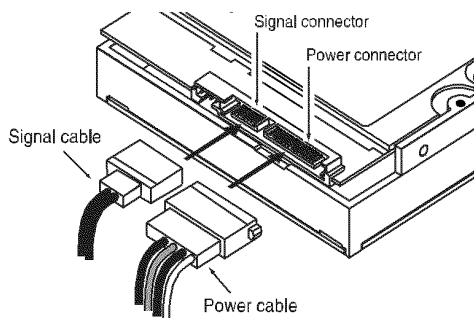
3.3 SATA cables and connectors

The SATA interface cable consists of four conductors in two differential pairs, plus three ground connections. The cable size may be 30 to 26 AWG with a maximum length of one meter (39.37 inches). See **Table 10** for connector pin definitions. Either end of the SATA signal cable can be attached to the drive or host.

For direct backplane connection, the drive connectors are inserted directly into the host receptacle. The drive and the host receptacle incorporate features that enable the direct connection to be hot pluggable and blind mateable.

For installations which require cables, users can connect the drive as illustrated in **Figure 1**.

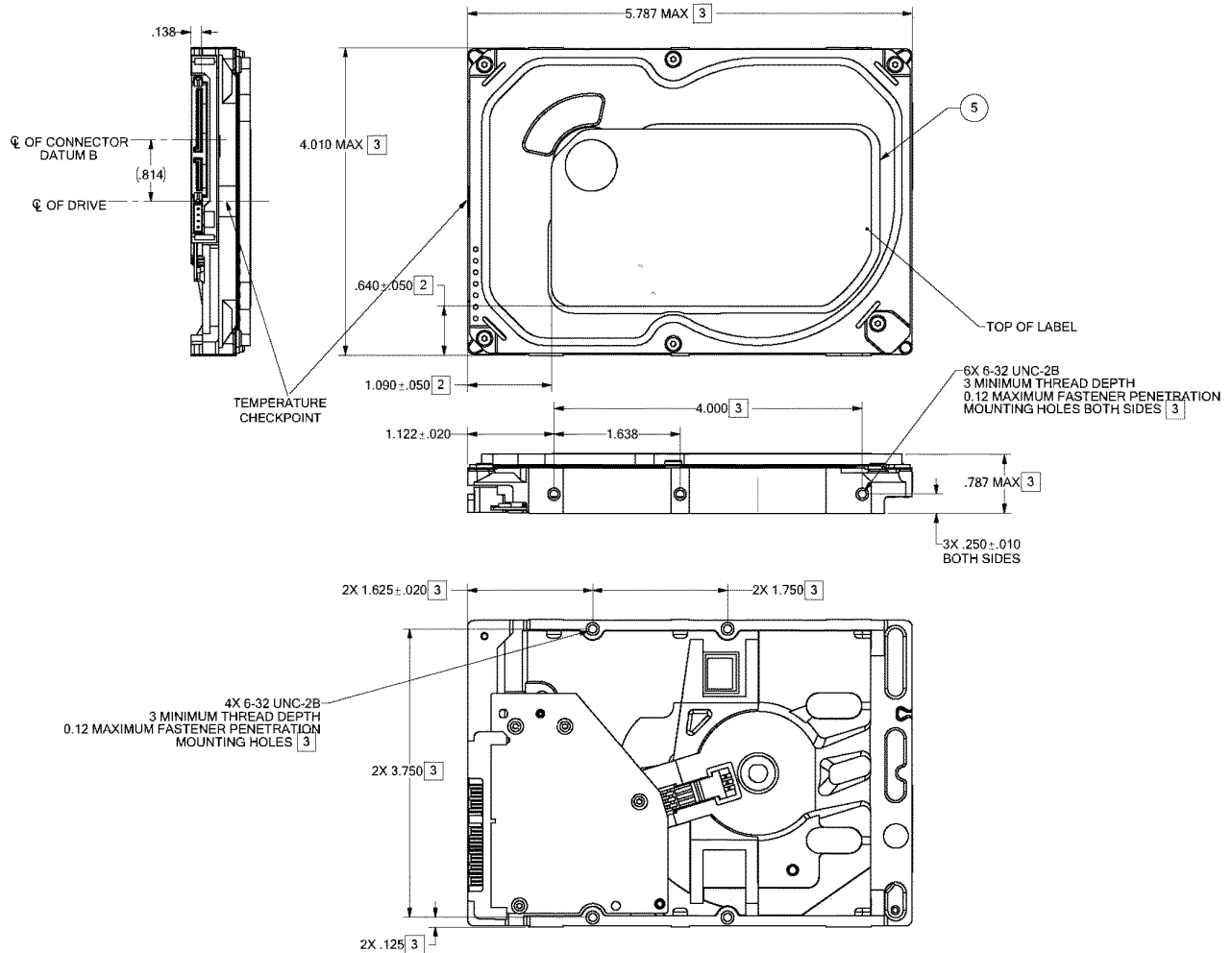
Figure 1 Attaching SATA cabling



Each cable is keyed to ensure correct orientation. Desktop HDD drives support latching SATA connectors.

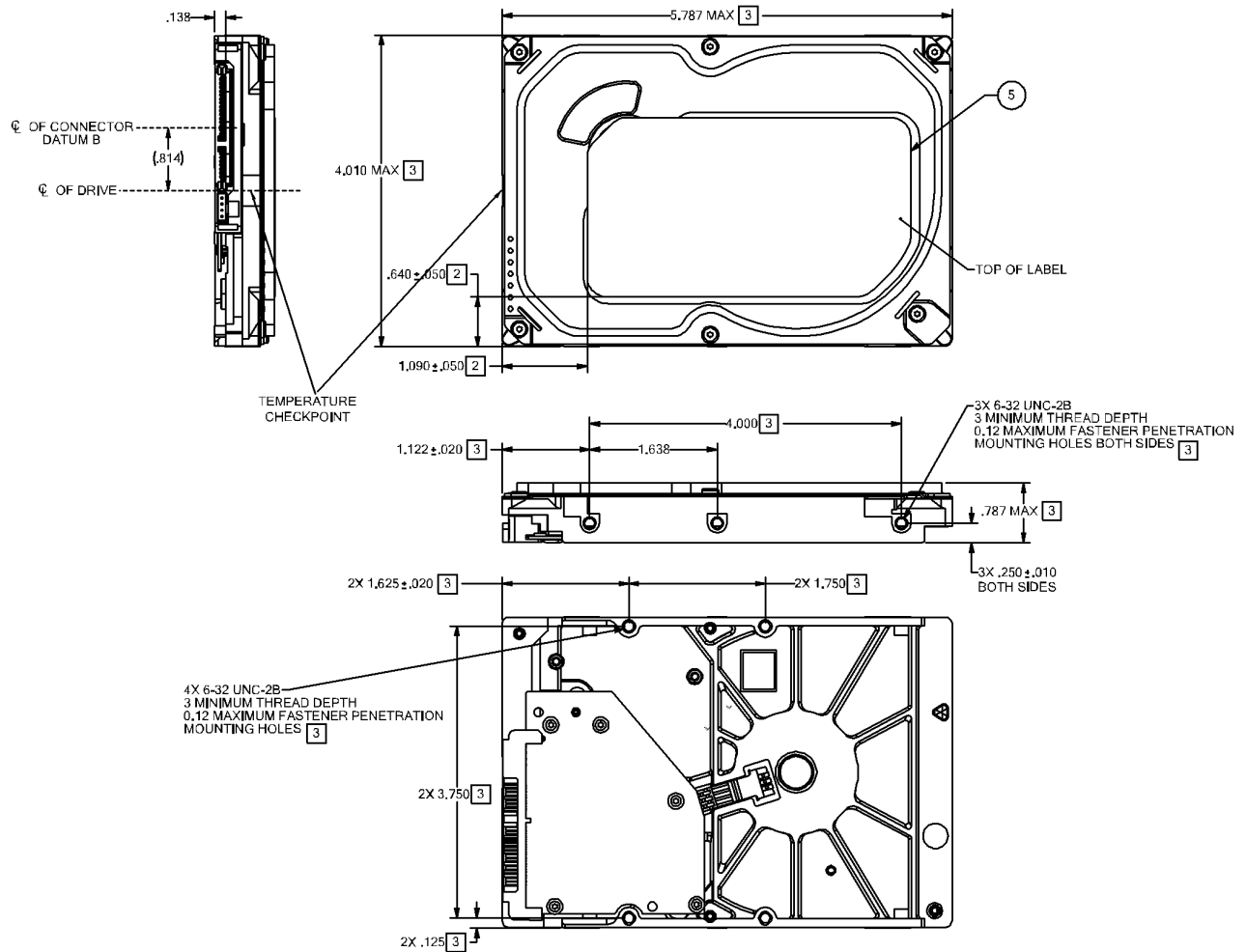
Seagate utilizes two base decks for 250GB through 1TB capacities, as shown below.

Figure 3 Mounting dimensions (configuration 1)



Note

Drawings are for mounting hole reference only.
PCBA show in pictorial only and can vary based on specific customer configurations.

Figure 4 Mounting dimensions (configuration 2)**Note**

Drawings are for mounting hole reference only.
PCBA show in pictorial only and can vary based on specific customer configurations.

4.0 About (SED) Self-Encrypting Drives

Self-encrypting drives (SEDs) offer encryption and security services for the protection of stored data, commonly known as "data at rest". These drives are compliant with the Trusted Computing Group (TCG) Opal Storage Specifications as detailed in the following:

- TCG Storage Architecture Core Specification, Version 2.0 (see www.trustedcomputinggroup.org)
- TCG Storage Security Subsystem Class Opal Specification, Version 2.0 (see www.trustedcomputinggroup.org)

In case of conflict between this document and any referenced document, this document takes precedence.

The Trusted Computing Group (TCG) is a standards organization sponsored and operated by companies in the computer, storage and digital communications industry. Seagate's SED models comply with the standards published by the TCG.

To use the security features in the drive, the host must be capable of constructing and issuing the following two SATA commands:

- Trusted Send
- Trusted Receive

These commands are used to convey the TCG protocol to and from the drive in their command payloads. Seagate Secure SEDs also support TCG Single User Mode, which can be disabled.

4.1 Data Encryption

Encrypting drives use one inline encryption engine within each drive employing AES-256 algorithms in Cipher Block Chaining (CBC) mode to encrypt all data prior to being written on the media and to decrypt all data as it is read from the media. The encryption engine is always in operation and cannot be disabled. The 32-byte Data Encryption Key (DEK) is a random number which is generated by the drive, never leaves the drive, and is inaccessible to the host system. The DEK is itself encrypted when it is stored on the media and when in volatile temporary storage (DRAM), which is external to the encryption engine. A unique data encryption key is used for each of the drive's possible 16 data bands (see [Section 4.5 Data Bands](#)).

4.2 Controlled Access

The drive has two security providers (SPs) called the "Admin SP" and the "Locking SP." These act as gatekeepers to the drive security services. Security-related commands will not be accepted unless the user provides the correct credentials to prove that they are authorized to perform the command.

4.2.1 Admin SP

The Admin SP allows the drive's owner to enable or disable firmware download operations (see [Section 4.4 Drive Locking](#)). Access to the Admin SP is available using the SID (Secure ID) password.

4.2.2 Locking SP

The Locking SP controls read/write access to the media and the cryptographic erase feature. Access to the Locking SP is available using the Admin or User passwords.

4.2.3 Default password

When the drive is shipped from the factory, all passwords are set to the value of MSID. This 32-byte random value can only be read by the host electronically over the interface. After receipt of the drive, it is the responsibility of the owner to use the default MSID password as the authority to change all other passwords to unique owner-specified values.

4.2.4 ATA Enhanced Security

The drive can utilize the system's BIOS through the ATA Security API for cases that do not require password management and additional security policies.

Furthermore, the drive's ATA Security Erase Unit command shall support both Normal and Enhanced Erase modes with the following modifications/additions:

Normal Erase: Normal erase feature shall be performed by changing the Data Encryption Key (DEK) of the drive, followed by an overwrite operation that repeatedly writes a single sector containing random data to the entire drive. This write operation bypasses the media encryption. On reading back the overwritten sectors, the host will receive a decrypted version, using the new DEK of the random data sector (the returned data will not match what was written).

Enhanced Erase: Enhanced erase shall be performed by changing the Data Encryption Key of the drive.

4.3 Random Number Generator (RNG)

The drive has a 32-byte hardware RNG that it uses to derive encryption keys or, if requested to do so, to provide random numbers to the host for system use, including using these numbers as Authentication Keys (passwords) for the drive's Admin and Locking SPs.

4.4 Drive Locking

In addition to changing the passwords, as described in [Section 4.2.3 Default password](#), the owner should also set the data access controls for the individual bands.

The variable "LockOnReset" should be set to "PowerCycle" to ensure that the data bands will be locked if power is lost. In addition "ReadLockEnabled" and "WriteLockEnabled" must be set to true in the locking table in order for the bands "LockOnReset" setting of "PowerCycle" to actually lock access to the band when a "PowerCycle" event occurs. This scenario occurs if the drive is removed from its cabinet. The drive will not honor any data read or write requests until the bands have been unlocked. This prevents the user data from being accessed without the appropriate credentials when the drive has been removed from its cabinet and installed in another system.

4.5 Data Bands

When shipped from the factory, the drive is configured with a single data band called Band 0 (also known as the Global Data Band) which comprises LBA 0 through LBA max. The host may allocate additional bands (Band1 to Band15) by specifying a start LBA and an LBA range. The real estate for this band is taken from the Global Band.

Data bands cannot overlap but they can be sequential with one band ending at LBA (x) and the next beginning at LBA (x+1).

Each data band has its own drive-generated encryption key. The host may change the Encryption Key (see [Section 4.6 Cryptographic Erase](#)) or the password when required.

4.6 Cryptographic Erase

A valuable feature of SEDs is the ability to perform a cryptographic erase. This involves the host telling the drive to change the data encryption key for a particular band. Once changed, the data is no longer recoverable since it was written with one key and will be read using a different key. Since the drive overwrites the old key with the new one, and keeps no history of key the older key, the user data can never be recovered. This is done in a matter of seconds and is very useful if the drive is to be scrapped or repurposed.

4.7 Authenticated Firmware Download

In addition to providing a locking mechanism to prevent unwanted firmware download attempts, the drive also only accepts download files which have been cryptographically signed by the appropriate Seagate Design Center.

Three conditions must be met before the drive will allow the download operation:

1. The download must be an SED file. A standard drive (non-SED) file will be rejected.
2. The download file must be signed and authenticated.
3. As with a non-SED drive, the download file must pass the acceptance criteria for the drive. For example it must be applicable to the correct drive model, and have compatible revision and customer status.

4.8 Power Requirements

The standard drive models and the SED drive models have identical hardware, however the security and encryption portion of the drive controller ASIC is enabled and functional in the SED models. This represents a small additional drain on the 5V supply of about

30mA and a commensurate increase of about 150mW in power consumption. There is no additional drain on the 12V supply. See the tables in [Section 2.8 Power specifications](#) for power requirements on the standard (non-SED) drive models.

4.9 Supported Commands

The SED models support the following two commands in addition to the commands supported by the standard (non-SED) models as listed in [Table 11](#):

- Trusted Send
- Trusted Receive

4.10 RevertSP

SED models will support the RevertSP feature which erases all data in all bands on the device and returns the contents of all SPs (Security Providers) on the device to their original factory state. In order to execute the RevertSP method the unique PSID (Physical Secure ID) printed on the drive label must be provided. PSID is not electronically accessible and can only be manually read from the drive label or scanned in via the 2D barcode.

5.0 SATA Interface

These drives use the industry-standard Serial ATA (SATA) interface that supports FIS data transfers. It supports ATA programmed input/output (PIO) modes 0 to 4; multiword DMA modes 0 to 2, and Ultra DMA modes 0 to 6.

For detailed information about the SATA interface, refer to the “Serial ATA: High Speed Serialized AT Attachment” specification.

5.1 Hot-Plug compatibility

Desktop HDD drives incorporate connectors which enable users to hot plug these drives in accordance with the SATA Revision 3.2 specification. This specification can be downloaded from www.serialata.org.

5.2 SATA device plug connector pin definitions

Table 10 summarizes the signals on the SATA interface and power connectors.

Table 10 SATA connector pin definitions

Segment	Pin	Function	Definition
Signal	S1	Ground	2nd mate
	S2	A+	Differential signal pair A from Phy
	S3	A-	
	S4	Ground	2nd mate
	S5	B-	Differential signal pair B from Phy
	S6	B+	
	S7	Ground	2nd mate
Key and spacing separate signal and power segments			
Power	P1	V ₃₃	3.3V power
	P2	V ₃₃	3.3V power
	P3	V ₃₃	3.3V power, pre-charge, 2nd mate
	P4	Ground	1st mate
	P5	Ground	2nd mate
	P6	Ground	2nd mate
	P7	V ₅	5V power, pre-charge, 2nd mate
	P8	V ₅	5V power
	P9	V ₅	5V power
	P10	Ground	2nd mate
	P11	Ground or LED signal	If grounded, drive does not use deferred spin
	P12	Ground	1st mate.
	P13	V ₁₂	12V power, pre-charge, 2nd mate
	P14	V ₁₂	12V power
	P15	V ₁₂	12V power

Notes

- All pins are in a single row, with a 1.27 mm (0.050 in) pitch.
- The comments on the mating sequence apply to the case of backplane blindmate connector only. In this case, the mating sequences are:
 - the ground pins P4 and P12.
 - the pre-charge power pins and the other ground pins.
 - the signal pins and the rest of the power pins.
- There are three power pins for each voltage. One pin from each voltage is used for pre-charge when installed in a blind-mate backplane configuration.
 - All used voltage pins (V_x) must be terminated.

5.3 Supported ATA commands

The following table lists SATA standard commands that the drive supports.

For a detailed description of the ATA commands, refer to the Serial ATA International Organization: Serial ATA Revision 3.0 (<http://www.sata-io.org>).

See “S.M.A.R.T. commands” on page 37 for details and subcommands used in the S.M.A.R.T. implementation.

Table 11 SATA standard commands

Command name	Command code (in hex)
Check Power Mode	E5 _H
Device Configuration Freeze Lock	B1 _H / C1 _H
Device Configuration Identify	B1 _H / C2 _H
Device Configuration Restore	B1 _H / C0 _H
Device Configuration Set	B1 _H / C3 _H
Device Reset	08 _H
Download Microcode	92 _H
Execute Device Diagnostics	90 _H
Flush Cache	E7 _H
Flush Cache Extended	EA _H
Format Track	50 _H
Identify Device	EC _H
Idle	E3 _H
Idle Immediate	E1 _H
Initialize Device Parameters	91 _H
Read Buffer	E4 _H
Read DMA	C8 _H
Read DMA Extended	25 _H
Read DMA Without Retries	C9 _H
Read Log Ext	2F _H
Read Multiple	C4 _H
Read Multiple Extended	29 _H
Read Native Max Address	F8 _H
Read Native Max Address Extended	27 _H
Read Sectors	20 _H
Read Sectors Extended	24 _H
Read Sectors Without Retries	21 _H
Read Verify Sectors	40 _H
Read Verify Sectors Extended	42 _H
Read Verify Sectors Without Retries	41 _H
Recalibrate	10 _H
Security Disable Password	F6 _H
Security Erase Prepare	F3 _H
Security Erase Unit	F4 _H

Table 11 SATA standard commands (continued)

Command name	Command code (in hex)	
Security Freeze	F5 _H	
Security Set Password	F1 _H	
Security Unlock	F2 _H	
Seek	70 _H	
Set Features	EF _H	
Set Max Address	F9 _H	
Note: Individual Set Max Address commands are identified by the value placed in the Set Max Features register as defined to the right.	Address: Password: Lock: Unlock: Freeze Lock:	00 _H 01 _H 02 _H 03 _H 04 _H
Set Max Address Extended	37 _H	
Set Multiple Mode	C6 _H	
Sleep	E6 _H	
S.M.A.R.T. Disable Operations	B0 _H / D9 _H	
S.M.A.R.T. Enable/Disable Autosave	B0 _H / D2 _H	
S.M.A.R.T. Enable Operations	B0 _H / D8 _H	
S.M.A.R.T. Execute Offline	B0 _H / D4 _H	
S.M.A.R.T. Read Attribute Thresholds	B0 _H / D1 _H	
S.M.A.R.T. Read Data	B0 _H / D0 _H	
S.M.A.R.T. Read Log Sector	B0 _H / D5 _H	
S.M.A.R.T. Return Status	B0 _H / DA _H	
S.M.A.R.T. Save Attribute Values	B0 _H / D3 _H	
S.M.A.R.T. Write Log Sector	B0 _H / D6 _H	
Standby	E2 _H	
Standby Immediate	E0 _H	
Write Buffer	E8 _H	
Write DMA	CA _H	
Write DMA Extended	35 _H	
Write DMA FUA Extended	3D _H	
Write DMA Without Retries	CB _H	
Write Log Extended	3F _H	
Write Multiple	C5 _H	
Write Multiple Extended	39 _H	
Write Multiple FUA Extended	CE _H	
Write Sectors	30 _H	
Write Sectors Without Retries	31 _H	
Write Sectors Extended	34 _H	
Write Uncorrectable	45 _H	

5.3.1 Identify Device command

The Identify Device command (command code EC_H) transfers information about the drive to the host following power up. The data is organized as a single 512-byte block of data, whose contents are shown in on page 30. All reserved bits or words should be set to zero. Parameters listed with an "x" are drive-specific or vary with the state of the drive.

The following commands contain drive-specific features that may not be included in the SATA specification.

Table 12 Identify Device commands

Word	Description	Value
0	Configuration information: <ul style="list-style-type: none"> • Bit 15: 0 = ATA; 1 = ATAPI • Bit 7: removable media • Bit 6: removable controller • Bit 0: reserved 	0C5A _H
1	Number of logical cylinders	16,383
2	ATA-reserved	0000 _H
3	Number of logical heads	16
4	Retired	0000 _H
5	Retired	0000 _H
6	Number of logical sectors per logical track: 63	003F _H
7–9	Retired	0000 _H
10–19	Serial number: (20 ASCII characters, 0000 _H = none)	ASCII
20	Retired	0000 _H
21	Retired	0400 _H
22	Obsolete	0000 _H
23–26	Firmware revision (8 ASCII character string, padded with blanks to end of string)	x.xx
27–46	Drive model number: (40 ASCII characters, padded with blanks to end of string)	
47	(Bits 7–0) Maximum sectors per interrupt on Read multiple and Write multiple (16)	8010 _H
48	Reserved	0000 _H
49	Standard Standby timer, IORDY supported and may be disabled	2F00 _H
50	ATA-reserved	0000 _H
51	PIO data-transfer cycle timing mode	0200 _H
52	Retired	0200 _H
53	Words 54–58, 64–70 and 88 are valid	0007 _H
54	Number of current logical cylinders	xxxx _H
55	Number of current logical heads	xxxx _H
56	Number of current logical sectors per logical track	xxxx _H
57–58	Current capacity in sectors	xxxx _H
59	Number of sectors transferred during a Read Multiple or Write Multiple command	xxxx _H

Table 12 Identify Device commands (continued)

Word	Description	Value
60–61	Total number of user-addressable LBA sectors available (see Section 2.2 for related information) *Note: The maximum value allowed in this field is: 0FFFFFFFh (268,435,455 sectors, 137GB). Drives with capacities over 137GB will have 0FFFFFFFh in this field and the actual number of user-addressable LBAs specified in words 100–103. This is required for drives that support the 48-bit addressing feature.	0FFFFFFFh*
62	Retired	0000 _H
63	Multiword DMA active and modes supported (see note following this table)	xx07 _H
64	Advanced PIO modes supported (modes 3 and 4 supported)	0003 _H
65	Minimum multiword DMA transfer cycle time per word (120 nsec)	0078 _H
66	Recommended multiword DMA transfer cycle time per word (120 nsec)	0078 _H
67	Minimum PIO cycle time without IORDY flow control (240 nsec)	0078 _H
68	Minimum PIO cycle time with IORDY flow control (120 nsec)	0078 _H
69–74	ATA-reserved	0000 _H
75	Queue depth	001F _H
76	SATA capabilities	xxxx _H
77	Reserved for future SATA definition	xxxx _H
78	SATA features supported	xxxx _H
79	SATA features enabled	xxxx _H
80	Major version number	01F0 _H
81	Minor version number	0028 _H
82	Command sets supported	364B _H
83	Command sets supported	7F09 _H
84	Command sets support extension (see note following this table)	4163 _H
85	Command sets enabled	30xx _H
86	Command sets enabled	BE09 _H
87	Command sets enable extension	4163 _H
88	Ultra DMA support and current mode (see note following this table)	xx7F _H
89	Security erase time	0039 _H
90	Enhanced security erase time	0039 _H
92	Master password revision code	FFFE _H
93	Hardware reset value	xxxx _H
94	Automatic acoustic management	8080 _H
95–99	ATA-reserved	0000 _H

Table 12 Identify Device commands (continued)

Word	Description	Value
100–103	Total number of user-addressable LBA sectors available (see Section 2.2 for related information). These words are required for drives that support the 48-bit addressing feature. Maximum value: 0000FFFFFFFFFh.	ST3000DM001 = 5,860,533,168 ST3000DM002 = 5,860,533,168 ST2000DM001 = 3,907,029,168 ST2000DM002 = 3,907,029,168 ST1000DM003 = 1,953,525,168 ST1000DM004 = 1,953,525,168 ST500DM002 = 976,773,168 ST320DM000 = 625,142,448 ST250DM000 = 488,397,168
104–107	ATA-reserved	0000 _H
108–111	The mandatory value of the world wide name (WWN) for the drive. NOTE: This field is valid if word 84, bit 8 is set to 1 indicating 64-bit WWN support.	Each drive will have a unique value.
112–127	ATA-reserved	0000 _H
128	Security status	0001 _H
129–159	Seagate-reserved	xxxx _H
160–254	ATA-reserved	0000 _H
255	Integrity word	xxA5 _H

Note

Advanced Power Management (APM) and Automatic Acoustic Management (AAM) features are not supported.

Note

See the bit descriptions below for words 63, 84, and 88 of the Identify Drive data.

Description (if bit is set to 1)		
	Bit	Word 63
	0	Multiword DMA mode 0 is supported.
	1	Multiword DMA mode 1 is supported.
	2	Multiword DMA mode 2 is supported.
	8	Multiword DMA mode 0 is currently active.
	9	Multiword DMA mode 1 is currently active.
	10	Multiword DMA mode 2 is currently active.
	Bit	Word 84
	0	SMART error login is supported.
	1	SMART self-test is supported.
	2	Media serial number is supported.
	3	Media Card Pass Through Command feature set is supported.
	4	Streaming feature set is supported.
	5	GPL feature set is supported.
	6	WRITE DMA FUA EXT and WRITE MULTIPLE FUA EXT commands are supported.

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	7	WRITE DMA QUEUED FUA EXT command is supported.
	8	64-bit World Wide Name is supported.
	9-10	Obsolete.
	11-12	Reserved for TLC.
	13	IDLE IMMEDIATE command with IUNLOAD feature is supported.
	14	Shall be set to 1.
	15	Shall be cleared to 0.
	Bit	Word 88
	0	Ultra DMA mode 0 is supported.
	1	Ultra DMA mode 1 is supported.
	2	Ultra DMA mode 2 is supported.
	3	Ultra DMA mode 3 is supported.
	4	Ultra DMA mode 4 is supported.
	5	Ultra DMA mode 5 is supported.
	6	Ultra DMA mode 6 is supported.
	8	Ultra DMA mode 0 is currently active.
	9	Ultra DMA mode 1 is currently active.
	10	Ultra DMA mode 2 is currently active.
	11	Ultra DMA mode 3 is currently active.
	12	Ultra DMA mode 4 is currently active.
	13	Ultra DMA mode 5 is currently active.
	14	Ultra DMA mode 6 is currently active.

5.3.2 Set Features command

This command controls the implementation of various features that the drive supports. When the drive receives this command, it sets BSY, checks the contents of the Features register, clears BSY and generates an interrupt. If the value in the register does not represent a feature that the drive supports, the command is aborted. Power-on default has the read look-ahead and write caching features enabled. The acceptable values for the Features register are defined as follows:

Table 13 Set Features command

02 _H	Enable write cache (<i>default</i>).
03 _H	Set transfer mode (based on value in Sector Count register). Sector Count register values:
00 _H	Set PIO mode to default (PIO mode 2).
01 _H	Set PIO mode to default and disable IORDY (PIO mode 2).
08 _H	PIO mode 0
09 _H	PIO mode 1
0A _H	PIO mode 2
0B _H	PIO mode 3
0C _H	PIO mode 4 (<i>default</i>)
20 _H	Multiword DMA mode 0
21 _H	Multiword DMA mode 1
22 _H	Multiword DMA mode 2
40 _H	Ultra DMA mode 0
41 _H	Ultra DMA mode 1
42 _H	Ultra DMA mode 2
43 _H	Ultra DMA mode 3
44 _H	Ultra DMA mode 4
45 _H	Ultra DMA mode 5
46 _H	Ultra DMA mode 6
10 _H	Enable use of SATA features
55 _H	Disable read look-ahead (read cache) feature.
82 _H	Disable write cache
90 _H	Disable use of SATA features
AA _H	Enable read look-ahead (read cache) feature (<i>default</i>).
F1 _H	Report full capacity available

Note

At power-on, or after a hardware or software reset, the default values of the features are as indicated above.

5.3.3 S.M.A.R.T. commands

S.M.A.R.T. provides near-term failure prediction for disk drives. When S.M.A.R.T. is enabled, the drive monitors predetermined drive attributes that are susceptible to degradation over time. If self-monitoring determines that a failure is likely, S.M.A.R.T. makes a status report available to the host. Not all failures are predictable. S.M.A.R.T. predictability is limited to the attributes the drive can monitor. For more information on S.M.A.R.T. commands and implementation, see the *Draft ATA-5 Standard*.

SeaTools diagnostic software activates a built-in drive self-test (DST S.M.A.R.T. command for D4_H) that eliminates unnecessary drive returns. The diagnostic software ships with all new drives and is also available at: <http://seatools.seagate.com>.

This drive is shipped with S.M.A.R.T. features disabled. Users must have a recent BIOS or software package that supports S.M.A.R.T. to enable this feature. The table below shows the S.M.A.R.T. command codes that the drive uses.

Table 14 S.M.A.R.T. commands

Code in features register	S.M.A.R.T. command
D0 _H	S.M.A.R.T. Read Data
D2 _H	S.M.A.R.T. Enable/Disable Attribute Autosave
D3 _H	S.M.A.R.T. Save Attribute Values
D4 _H	S.M.A.R.T. Execute Off-line Immediate (runs DST)
D5 _H	S.M.A.R.T. Read Log Sector
D6 _H	S.M.A.R.T. Write Log Sector
D8 _H	S.M.A.R.T. Enable Operations
D9 _H	S.M.A.R.T. Disable Operations
DA _H	S.M.A.R.T. Return Status

Note

If an appropriate code is not written to the Features Register, the command is aborted and 0x04 (abort) is written to the Error register.



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FED_SEAG0030293

Metadata

FileName	BARRACUDA Desktop HDD.pdf	ORIGINAL
OrgFolder	BARRACUDA	ORIGINAL
Relativity Image Count	39	ORIGINAL

EXHIBIT 58

Message

From: Anik Rubalcava-Capretta [anik.rubalcava-capretta@seagate.com]
Sent: 12/15/2011 7:02:10 PM
To: Dave M Rollings [dave.m.rollings@seagate.com]
Subject: Fwd: Drives not being detected

FYI -

----- Forwarded message -----

From: **Mike S Carlow** <mike.s.carlow@seagate.com>
Date: Thu, Dec 15, 2011 at 10:56 AM
Subject: Re: Drives not being detected
To: John W Bornholdt <john.w.bornholdt@seagate.com>
Cc: Keith Myers <keith.r.myers@seagate.com>, Anik Rubalcava-Capretta <anik.rubalcava-capretta@seagate.com>

John,

Grenada FW is now rolling to CC49 and should be available Monday. Once its available we will send a FW load package. At first glance at the FW changes they don't highlight and detection fixes.

We can try this new FW and go from there.

Mike

On Thu, Dec 15, 2011 at 11:15 AM, John W Bornholdt <john.w.bornholdt@seagate.com> wrote:
Hi Mike and Keith,

I understand that we're working on a firmware roll for the Grenada 3TB desktop drive. We got a large channel customer who has delivered several systems to Netflix with the 3TB drive, and they are failing at a very concerning rate. Netflix and Equus are both very anxious about what is happening, and it sounds like the firmware roll might address the issue. Is there anything we can do to expedite firmware delivery for Equus to validate the fix and keep these important customers in the fold?

Thanks,
John

John Bornholdt
Seagate Technology | Channel Sales - Central U.S.
Office: 952-923-1008 (*new office number*)
Mobile: 612-845-3695

----- Forwarded message -----

From: **John Dotson** <jdotson@equuscs.com>
Date: Thu, Dec 15, 2011 at 11:13 AM
Subject: RE: Drives not being detected
To: Anik Rubalcava-Capretta <anik.rubalcava-capretta@seagate.com>, "dave.m.rollings@seagate.com" <dave.m.rollings@seagate.com>

Cc: Will Wu <WWu@equuscs.com>, Tim Poor <TPoor@equuscs.com>, "john.w.bornholdt@seagate.com" <john.w.bornholdt@seagate.com>, Netty Ng <NNg@equuscs.com>, Eddie Ramirez <eramirez@equuscs.com>

Anik,

Did the firmware division give you an idea as to when the CC47 firmware will be available and released to you?

John

From: Anik Rubalcava-Capretta [mailto:anik.rubalcava-capretta@seagate.com]
Sent: Thursday, December 15, 2011 8:57 AM
To: John Dotson; dave.m.rollings@seagate.com
Cc: Will Wu; Tim Poor; john.w.bornholdt@seagate.com; Netty Ng; Eddie Ramirez

Subject: Re: Drives not being detected

Hi John,

I just left you a voicemail.

The new firmware revision is not available yet. I am waiting for firmware to send the firmware package.

As soon as I receive it, I will provide it to you as well.

Best Regards,

Anik

From: John Dotson [mailto:jdotson@equuscs.com]
Sent: Thursday, December 15, 2011 10:12 AM
To: John Dotson <jdotson@equuscs.com>; 'Anik Rubalcava-Capretta' <anik.rubalcava-capretta@seagate.com>; Dave M Rollings <dave.m.rollings@seagate.com>
Cc: Will Wu <WWu@equuscs.com>; Tim Poor <TPoor@equuscs.com>; 'John W Bornholdt' <john.w.bornholdt@seagate.com>; Netty Ng <NNg@equuscs.com>; Eddie Ramirez <eramirez@equuscs.com>
Subject: RE: Drives not being detected

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May I have an update this morning? The drives we sent to the customer are "failing" in large volumes, even though we pre-tested them before they shipped, and even though the customer pre-tested them before shipping to their end locations.

John

From: John Dotson
Sent: Wednesday, December 14, 2011 2:45 PM
To: 'Anik Rubalcava-Capretta'

Cc: Will Wu; Dave M Rollings; Tim Poor; John W Bornholdt; Netty Ng; Eddie Ramirez
Subject: RE: Drives not being detected

Anik,

Thanks for the update. The firmware CC47 must have just been released in the last couple of weeks, because you checked for me on 11/21 and there was not a firmware at that time.

Can you provide me the firmware and the release notes for CC47?

On the desktop platform I was testing the drive on, the boot time is pretty quick, and with those "failing" drives connected the motherboard would wait for about two minute and then time out. The other platform we are using takes from a cold boot about 20 seconds before it initializes the HBA firmware. If we disable the HBA firmware and let the system boot up, and then allow the driver to initialize the drives are still missing.

The OS the customer is using is freeBSD 9, but we are testing at the BIOS level, Windows XP and WinPE with the same results of not detecting at P.O.S.T.

John

From: Anik Rubalcava-Capretta [mailto:anik.rubalcava-capretta@seagate.com]

Sent: Wednesday, December 14, 2011 2:08 PM

To: John Dotson

Cc: Will Wu; Dave M Rollings; Tim Poor; John W Bornholdt; Netty Ng; Eddie Ramirez

Subject: Re: Drives not being detected

Hi John,

We retested the drives several times and were able to reproduce the issue.

It is an interesting issue because when we hook up our internal test tool to the drives, the drives power up consistently with no problems. If I remove the internal test tool the drives will fail to be recognized.

What OS are the drives used in? Are you aware how much time is allowed to spin-up?

The drives have an older revision of firmware, the latest revision is CC47. The next step will be to load the latest firmware and retest the drives.

After testing with the latest firmware revision, the next step will be to capture a bus trace of the failure. A bus trace will allow us to see what commands are being sent to the drive and how the drive is responding.

Best Regards,

Anik

On Wed, Dec 14, 2011 at 11:04 AM, John Dotson <jdotson@equuscs.com> wrote:

Anik,

Our customer is asking us for an update. Has your engineer been able to get any of the other QTY.4 drives to fail? Has he been able to analyze the problem with the drive that failed?

We have no shortage of drives that have cold boot problems, if you need more samples.

We did a quick power on test of the drives right after opening the packaging of 144 drives, and found 17 drives that were not detected upon a cold boot. After mounting the "good" drives into the systems, we are finding that some of those drives have cold boot problems.

Please advise if you need any more information or details from us to help in troubleshooting this issue.

John

From: John Dotson

Sent: Tuesday, December 13, 2011 2:32 PM

To: 'Anik Rubalcava-Capretta'

Cc: Will Wu; Dave M Rollings; Tim Poor; John W Bornholdt; Netty Ng; Eddie Ramirez

Subject: RE: Drives not being detected

Anik,

All the drives that we had sent were tested upon a second separate platform. It appeared that upon a cold boot (not having power applied to them for several minutes) the drives would not be detected, but then after a warm boot the drives were subsequently detected. If we powered the system down for a few minutes and then back on, the drive would exhibit the same behavior of not be detected again.

If a drive does not spin up or has a delayed spin up, would that information be stored in a log on the drive?

I have moved these drives to other platforms, and the "detection" problem follows the drives.

John

From: Anik Rubalcava-Capretta [mailto:anik.rubalcava-capretta@seagate.com]

Sent: Tuesday, December 13, 2011 2:27 PM

To: John Dotson

Cc: Will Wu; Dave M Rollings; Tim Poor; John W Bornholdt; Netty Ng; Eddie Ramirez

Subject: Re: Drives not being detected

Hi John,

I tied off with Dave regarding your drives.

Four of the five drives sent are recognized by the interface. In reviewing the log files, the drives are clean and do not show any errors or problems.

Only 1 drive had trouble being recognized by the interface. This drive requires further analysis. We are working on it and will provide an update as soon as possible.

Thanks and Best Regards,

Anik

On Tue, Dec 13, 2011 at 2:14 PM, John Dotson <jdotson@equuscs.com> wrote:
Dave,

Have you had a chance to analyze the drives? Do you have any questions that I can answer for you?

John

From: Will Wu
Sent: Friday, December 09, 2011 5:33 PM
To: 'Dave M Rollings'; Tim Poor

Cc: Anik Rubalcava-Capretta; John Dotson; John W Bornholdt; Netty Ng; Eddie Ramirez
Subject: RE: Drives not being detected

Hi Dave,

Shipped today
Here is the tracking number

1Z68W0A40166225183

Should get there on Monday

Thanks

From: Dave M Rollings [<mailto:dave.m.rollings@seagate.com>]
Sent: Friday, December 09, 2011 9:07 AM
To: Tim Poor
Cc: Anik Rubalcava-Capretta; John Dotson; John W Bornholdt; Netty Ng; Eddie Ramirez; Will Wu
Subject: Re: Drives not being detected

Hi Tim,

Thanks for the update. I will look for the drives on Monday.

Have a nice weekend.

dave

Dave Rollings

Field Applications Engineering
Seagate Technology
10200 S. De ANZA Blvd,
Cupertino, Ca 95014
Cell 408 218 3013

On Thu, Dec 8, 2011 at 9:53 PM, Tim Poor <TPoor@equuscs.com> wrote:
Anik/Dave,

The drives did not make it out of our facility tonight, so they will ship tomorrow for Monday morning delivery.

Thank you,

Tim

From: Anik Rubalcava-Capretta [<mailto:anik.rubalcava-capretta@seagate.com>]
Sent: Thursday, December 08, 2011 5:29 PM
To: Tim Poor; Dave M Rollings
Cc: John Dotson; John W Bornholdt; Netty Ng; Eddie Ramirez
Subject: Re: Drives not being detected

Hi Tim,

Please ship 2-5 failing drives to the following address:

Seagate Technology
Attn: Dave Rollings
10200 South De Anza Blvd.
Cupertino, CA 95014

Thanks and Best Regards,

Anik

On Thu, Dec 8, 2011 at 3:01 PM, Tim Poor <TPoor@equuscs.com> wrote:

Anik,

We are building up seven of the systems for our large customer with 36 of the ST3000DM001 3TB drives in each system. We have had a number of hard drives that aren't recognized by the system at boot. Some drives will be recognized sporadically during multiple reboots, but others are not recognized as all. As a part of our troubleshooting process, we have moved the failed drives to a standard desktop system based on an Intel branded motherboard to see if the drive is recognized. Some of these drives are also not being recognized by the Intel board.

We would like to overnight a sampling of these failed drives to you to check the SMART system logs for any failure flags.

This level of hard drive failures is a severe concern for us, and we need to get to the bottom of this as quickly as possible.

Please let me know who/where we need to ship these drives for analysis.

Thank you,

Tim

Timothy Poor

Director, Field Application & Sales Engineering

Equus Computer Systems, Inc.

5801 Clearwater Drive

Minnetonka, MN 55343

O: 612-617-4317

F: 612-617-6298

tpoor@intequus.com

--

Best Regards,

Anik

Anik S. Rubalcava-Capretta

Sr. Customer Technical Support Engineer

Mobile: 949.315.1951

Email: Anik.Rubalcava-Capretta@seagate.com

--

Best Regards,

Anik

Anik S. Rubalcava-Capretta
Sr. Customer Technical Support Engineer
Mobile: 949.315.1951
Email: Anik.Rubalcava-Capretta@seagate.com

Best Regards,

Anik

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Anik

Anik S. Rubalcava-Capretta
Sr. Customer Technical Support Engineer
Mobile: 949.315.1951
Email: Anik.Rubalcava-Capretta@seagate.com

EXHIBIT 59

Subject: Re: Drives not being detected
From: Anik Rubalcava-Capretta <anik.rubalcava-capretta@seagate.com>
To: Mike S Carlow <mike.s.carlow@seagate.com>
Cc: John W Bornholdt <john.w.bornholdt@seagate.com>, Keith Myers <keith.r.myers@seagate.com>, Dave M Rollings <dave.m.rollings@seagate.com>

Mike,

Have you seen this issue with the Grenada drives not being detected? We showed the issue to Keith in Cupertino earlier this week.

This is a big issue at Equus and they are requesting this issue to be worked on during the holidays if it is not resolved beforehand. They have a 30% failure rate.

I'll have Equus ship you a few of the failing drives as well.

Thanks and Best Regards,

Anik

On Thu, Dec 15, 2011 at 10:56 AM, Mike S Carlow <mike.s.carlow@seagate.com> wrote:

John,

Grenada FW is now rolling to CC49 and should be available Monday. Once its available we will send a FW load package. At first glance at the FW changes they don't highlight and detection fixes.

We can try this new FW and go from there.

Mike

On Thu, Dec 15, 2011 at 11:15 AM, John W Bornholdt <john.w.bornholdt@seagate.com> wrote:

Hi Mike and Keith,

I understand that we're working on a firmware roll for the Grenada 3TB desktop drive. We got a large channel customer who has delivered several systems to Netflix with the 3TB drive, and they are failing at a very concerning rate. Netflix and Equus are both very anxious about what is happening, and it sounds like the firmware roll might address the issue. Is there anything we can do to expedite firmware delivery for Equus to validate the fix and keep these important customers in the fold?

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Mobile: 612-845-3695

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Subject: RE: Drives not being detected
To: Anik Rubalcava-Capretta <anik.rubalcava-capretta@seagate.com>, "dave.m.rollings@seagate.com" <dave.m.rollings@seagate.com>
Cc: Will Wu <WWu@equuscs.com>, Tim Poor <TPoor@equuscs.com>, "john.w.bornholdt@seagate.com" <john.w.bornholdt@seagate.com>, Netty Ng <NNg@equuscs.com>, Eddie Ramirez <eramirez@equuscs.com>

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Cc: Will Wu; Dave M Rollings; Tim Poor; John W Bornholdt; Netty Ng; Eddie Ramirez

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From: Will Wu

Sent: Friday, December 09, 2011 5:33 PM

To: 'Dave M Rollings'; Tim Poor

Cc: Anik Rubalcava-Capretta; John Dotson; John W Bornholdt; Netty Ng; Eddie Ramirez

Subject: RE: Drives not being detected

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Here is the tracking number

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Should get there on Monday

Thanks

From: Dave M Rollings [mailto:dave.m.rollings@seagate.com]

Sent: Friday, December 09, 2011 9:07 AM

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Cc: Anik Rubalcava-Capretta; John Dotson; John W Bornholdt; Netty Ng; Eddie Ramirez; Will Wu

Subject: Re: Drives not being detected

Hi Tim,

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Have a nice weekend.

dave

Dave Rollings
Field Applications Engineering
Seagate Technology
10200 S. De ANZA Blvd,
Cupertino, Ca 95014
Cell 408 218 3013

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Anik/Dave,

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Cc: John Dotson; John W Bornholdt; Netty Ng; Eddie Ramirez
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Seagate Technology
Attn: Dave Rollings
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This level of hard drive failures is a severe concern for us, and we need to get to the bottom of this as quickly as possible.

Please let me know who/where we need to ship these drives for analysis.

Thank you,

Tim

Timothy Poor

Director, Field Application & Sales Engineering

Equus Computer Systems, Inc.

5801 Clearwater Drive

Minnetonka, MN 55343

O: 612-617-4317

F: 612-617-6298

tpoor@intequus.com

--

Best Regards,

Anik

Anik S. Rubalcava-Capretta
Sr. Customer Technical Support Engineer
Mobile: 949.315.1951
Email: Anik.Rubalcava-Capretta@seagate.com

--
Best Regards,

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Best Regards,

Anik

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Sr. Customer Technical Support Engineer
Mobile: 949.315.1951
Email: Anik.Rubalcava-Capretta@seagate.com

EXHIBIT 60

Message

From: Raymond Wong [raymondw@synnex.com]
Sent: 6/25/2012 4:29:21 PM
To: dave.rollings@seagate.com
CC: electra.stockwell@seagate.com; Sherman Ng [shermann@synnex.com]
Subject: FW: Returning of Seagate hard drives

Hi Dave!

Did you get a chance to reach out to IX to resolve the firmware issue on the ST3000DM001? This is the same situation about the customer receiving "Dell OEM" drives.

Eeeeeeeeeeeeeee, fyi, we only have TAB-500 coming into stock...

Thanks-
Ray

-----Original Message-----

From: Helen Liu
Sent: Monday, June 25, 2012 9:25 AM
To: Raymond Wong
Cc: Bret Morris
Subject: FW: Returning of Seagate hard drives

Raymond

Can you follow up with Seagate (Dave Rollings) to see if they did reach out to IX and make an attempt to resolve w/out RMA?

Thanks

-----Original Message-----

From: Chris Try [mailto:ctry@ixsystems.com]
Sent: Friday, June 22, 2012 6:56 PM
To: Helen Liu
Cc: Bret Morris; austin@ixsystems.com
Subject: Returning of Seagate hard drives

Hello Helen,

We are looking to return a large batch of Seagate hard drives part# ST3000DM001. Unfortunately we are unable to use these hard drives due to the CC4B firmware. Please let me know if there are any procedures that I should pay attention to in order to complete this process. Thank you.

-Chris

--

Christopher Try
iXsystems, Inc.
408.943.4100 x115
408.943.4101 fax
ctry@iXsystems.com
www.iXsystems.com
"Enterprise Servers for Open Source."

EXHIBIT 61

Subject: Re: FW: RN 316 - not detecting disk 3TB HDD, Case ID 21090433.
From: Dave M Rollings <dave.m.rollings@seagate.com>
To: Albert Langarica <alangerica@netgear.com>

Hi Albert,

I do not see any of the attachments. What FW was on the ST3000DM001 drives that failed in the field? Our current shipping FW is CC27. I see that John was successful with an older FW CC43. I know it looks like we got out of sequence going from CC43 to CC27 but just look at the last digit. We went from a 3 to a 7.

In your logs I see the drive is showing a drive ready error and aborting a READ CMD.

Is this a boot up issue or a drive drop issue where the drive goes away?

Are you able to confirm this issue is only seen with a specific FW?

Depending on the answers to my questions we may need to replicate at Netgear and get a bus trace.

dave

Dave Rollings
Field Applications Engineering
Seagate Technology
10200 S. De ANZA Blvd,
Cupertino, Ca 95014
Cell 408 218 3013

On Mon, May 13, 2013 at 11:00 AM, Albert Langarica <alangerica@netgear.com> wrote:

Hi Dave,

When you get a chance take a look at the issue below.

-Albert

On 5/13/13 5:27 AM, "Marcus Fairbrother" <mfairbrother@netgear.com> wrote:

>Hi John / Albert

>

>Did you have a look at this?

>I see in logs a lot of

>

>May 05 15:00:09 nas-27-5B-76 kernel: ata5.00: exception Emask 0x0 SAct
 >0x0 SErr 0x0 action 0x0
 >May 05 15:00:09 nas-27-5B-76 kernel: ata5.00: irq_stat 0x40000001
 >May 05 15:00:09 nas-27-5B-76 kernel: ata5.00: failed command: READ DMA
 >May 05 15:00:09 nas-27-5B-76 kernel: ata5.00: cmd
 >c8/00:08:18:00:00/00:00:00:00/00/e0 tag 0 dma 4096 in
 >May 05 15:00:09 nas-27-5B-76 kernel: res
 >51/04:08:18:00:00/00:00:00:00/00/e0 Emask 0x1 (device error)
 >May 05 15:00:09 nas-27-5B-76 kernel: ata5.00: status: { DRDY ERR }
 >May 05 15:00:09 nas-27-5B-76 kernel: ata5.00: error: { ABRT }
 >May 05 15:00:09 nas-27-5B-76 kernel: ata5.00: configured for UDMA/133
 >May 05 15:00:09 nas-27-5B-76 kernel: ata5: EH complete
 >

>Do you think Seagate could tell if that firmware could cause an issue?

>

>Ales

>I am sorry L1 have picked up the case and gave some not so good advise
 >about return to supplier. Can you step in and explain looks like old
 >firmware on the Seagate drives is causing an issue. He can look to Seagte
 >website I believe there is method to upgrade those drives
 >

>Regards

>Marcus

>

>

>

>-----Original Message-----

>From: Ales Mudrunka

>Sent: 06 May 2013 10:05

>To: Marcus Fairbrother; John Chin; Davin Oishi; Josua Braun; Albert

>Langarica

>Cc: Richard Jonker

>Subject: RE: RN 316 - not detecting disk 3TB HDD, Case ID 21090433.

>

>Hi Marcus,

>

>Please see attached logs. Case is open under ID: 21090433.

>

>Regards

>Ales

>

>

>-----Original Message-----

>From: Marcus Fairbrother

>Sent: Thursday, May 02, 2013 10:58 AM

>To: Ales Mudrunka; John Chin; Davin Oishi; Josua Braun; Albert Langarica

>Cc: Richard Jonker
>Subject: RE: RN 316 - not detecting disk 3TB HDD
>
>Hi Ales
>
>Can we ask customer to start a case at my.netgear.com Also can we have a
>set of logs from the unit when they have the 250GB and 3 x 3TB
>
>The firmware is different that what John tested so maybe seagte have
>changed something
>
>Thanks
>Marcus
>
>-----Original Message-----
>From: Ales Mudrunka
>Sent: 02 May 2013 09:50
>To: John Chin; Davin Oishi; Marcus Fairbrother; Josua Braun; Albert
>Langarica
>Cc: Richard Jonker
>Subject: RE: RN 316 - not detecting disk 3TB HDD
>
>Hi All,
>
>Please find attached label of HDD. Thank you.
>
>Regards
>
>Aleš
>
>
>-----Original Message-----
>From: John Chin
>Sent: Wednesday, May 01, 2013 12:27 AM
>To: Davin Oishi; Ales Mudrunka; Marcus Fairbrother; Josua Braun; Albert
>Langarica; John Chin
>Cc: Richard Jonker
>Subject: Re: RN 316 - not detecting disk 3TB HDD
>
>I just tried it with a RN316 4x ST3000DM001 with firmware CC43 and it saw
>all 4 disks I had installed.
>
>Thanks
>John
>
>On 4/30/13 3:14 PM, "Davin Oishi" <doishi@netgear.com> wrote:

>
>>Albert,
>>Can you through a Seagate DM 3TB drive into a RN316 quickly and see if
>>it is detected?
>>
>>Ales,
>>Is it possible to take a photo of the entire hard drive label? So we
>>know the firmware version on the hard drive as well as the lot numbers.
>>I'm assuming when you swapped out and tested different drives that the
>>"other"
>>drives were in the same bay (so we know the bay works).
>>
>>-Davin
>>
>>
>>
>>
>>On 4/30/13 6:14 AM, "Ales Mudrunka" <amudrunka@netgear.com> wrote:
>>
>>>
>>>Just one more update regarding this case. It works fine with 2TB
>>>Samsung as well.
>>>
>>>Regards
>>>Ales
>>>
>>>
>>>-----Original Message-----
>>>From: Richard Jonker
>>>Sent: Tuesday, April 30, 2013 1:33 PM
>>>To: Ales Mudrunka
>>>Cc: Marcus Fairbrother; Josua Braun; Davin Oishi
>>>Subject: Re: RN 316 - not detecting disk 3TB HDD
>>>
>>>Adding Josua and Davin
>>>
>>>Regards,
>>>
>>>Richard Jonker
>>>NETGEAR
>>>
>>>On 30 apr. 2013, at 13:23, "Ales Mudrunka" <amudrunka@netgear.com>
>>>wrote:
>>>
>>>> Hi Marcus,
>>>>

>>>> Can you please advice? Customer bought RN316, SN: 3C613300009EF,
>>>>separately 4x HDD 3TB Seagate ST3000DM001. System is showing "NO HDD
>>>>DETECTED". They tried factory default etc. without success. They have
>>>>been successful to upgrade to 6.0.4 with 250 GB HDD and this HDD is
>>>>working ok. 80GB HDD was ok as well. It looks that system cannot
>>>>recognize 3TB HDD. Thank you.

>>>>

>>>> Regards

>>>> Ales

>>>>

>>>> -----Original Message-----

>>>> From: p.masar@vlp.cz [mailto:p.masar@vlp.cz]

>>>> Sent: Tuesday, April 30, 2013 11:33 AM

>>>> To: Ales Mudrunka

>>>> Subject: Dotaz z webu - po nákupu: RN 316

>>>>

>>>> Kontaktní osoba : Pavel Masar

>>>> Kontaktní email : p.masar@vlp.cz

>>>> Kontaktní telefon : 724285636

>>>> Předmět : RN 316

>>>> Zpráva : Dobrý den,

>>>>

>>>> zakoupili jsme Ready Nas 316 a k němu 4 disky 3TB Seagate

>>>>ST3000DM001, dle HCL listu na

>>>>http://www.netgear.com/images/HCL_RN6_0401201318-73531.pdf. Jsou

>>>>tedy být certifikovány výrobcem pro tento nas.

>>>> Disky však nejsou detekovány. Provedl jsem upgrade fw na poslední

>>>>verzi 6.0.4 pomocí menšího disku 250GB, ale ty velké stále nejsou v

>>>> systému. Co s tím ???

>>>>

>>>> Vyzkoušel jsem i jiný disk 3TB seagate a také není detekován.

>>>>

>>>> Serial nr toho nasu je 3C613300009EF.

>>>>

>>>> Děkuji,

>>>>

>>>> Pavel Masar

>>>>

>>>>

>>>>

>>>> Datum: 30.04.2013

>>>> Čas: 11:32

>>>>

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EXHIBIT 62

Sender: Anik Rubalcava-Capretta <anik.rubalcava-capretta@seagate.com>
Sent: Wednesday, October 8, 2014 11:13:28 AM
Recipient: tom.barrett@seagate.com
Cc: ramin.esmailzadeh@seagate.com
Subject: UC Irvine - Background Info.
Attachments: LogFilesAnalysis.pdf

Hi Tom,

Ramin and I spoke this morning and he mentioned we will have a call this afternoon to review UC Irvine.

Just to provide some background on UC Irvine.

They are using our Grenada Classic drive.

9YNxxx is Grenada Classic and the drives they are using are 2011 and 2012 vintage drives.

Early 2012 vintage Grenada has a 2x Field return rate over current drives based on Standard OEM field data (Feb-June 2012 RR on All OEM was ~0.7% vs. Oct-Nov 2013 RR of 0.3% on Grenada BP). This is due to a multitude of issues, including particle improvement mitigation actions, out gassing, an improved air bearing design (internal) on Grenada BP, FW fixes etc.

The drives in general they are using have bad quality.

Since these are desktop drives there are no accelerometers on the drive. Unfortunately, there are bugs with the internal log files and it appears to record the vibration, but these are random numbers. The data recorded is bogus data.

Also, because of a known issue with SMART log reporting of T transferred and POH on Grenada drives with POH reporting and total reads and writes it is impossible to get an accurate reading on TB written / Read per year. (For desktop: Workload Rate Limit: 55 TB/yr, avg, For Nearline: 550 TB/yr, avg)

The data in the log files for desktop is inaccurate. I am working with the Design Center to see if this can be addressed.

If we send a couple of these drives for full Failure Analysis, most probably the results will indicate that they are early vintage Grenada with poor quality.

UCI is using desktop drives in a 3U 36 enclosure, desktop drives are specified to be used as 1 drive/system. Based on this information I put together the attached report. Since the data in the log files is inaccurate it is not possible to add more detail to this report.

Look forward to speaking with you later today.

Best Regards,

Anik

Anik Rubalcava-Capretta

Seagate Technology | Customer Technical Support

Email: Anik.Rubalcava-Capretta@seagate.com | Mobile: 949.315.1951

EXHIBIT 64

No image available for this record.

Corporate Response Team Log FY16

Date Escalated from BBB	First Contact to Customer	Department / Group	Source	Region	Customer Name	Customer Contact Details	Customer's Complaint	Customer's Desired Resolution	Resolution Reason	Customer Data Line Complaint	Notes / Action
Closed	06/17/2015 09:30 AM	06/18/2015 02:47 PM	Warranty	BBB	AMER		<p>External Hard Drive failed. Seagate refused to assist in recovery. I was very disappointed with my conversations today with the Seagate representatives. I have a 1TB external hard drive (HDD) that is no longer being recognized on any of my computers. I have had the drive for less than 6 months, and the product is under warranty. I was simply told it would cost \$500 to recover and it would be 3 weeks. They informed me that the device is under warranty but not the data.</p> <p>The product has one function: to store data. You cannot separate the product from the function. To replace the product but not assist in the data recovery is tantamount to charging us twice for the same product. In addition to the poor customer service policy, the management team was less than helpful and unwilling to find a solution.</p> <p>Extra Detailed Info Complaint Date: 06/17/2015</p>	<p>Since the product is still under warranty, Seagate should be willing to both replace the hard drive and recover the data lost due to their faulty product.</p>	Drive Failure	Yes	<p>07/13 - Em2cust</p> <p>07/13</p> <p>Still unable to [redacted] - Left a detailed vsm msg including my direct contact ph #.</p> <p>07/07 - Em2cust Ashley,</p> <p>We have submitted an extension request with the BBB. Please reply to this email with your preferred date & time for contact so we can discuss your concerns. I will make the necessary arrangements to contact you at the desired time. You are more than welcome to contact me directly at (402) 324-4262. Simply respond with what time to expect your call. Look forward to speaking with you soon.</p> <p>(Best Regards, 7Shereonda</p> <p>07/08 - Em2cust</p>
Closed	08/10/2015 09:30 AM	08/22/2015 09:40 AM	Warranty	BBB	AMER		<p>Replacement hard drive is failing. Unable to get warranty replacement.</p> <p>SR: S17009K3 MODEL: ST2000VX000 PN: 9YV164-500 FW: CV13 DATE: 12/33 SITE: SU CSD LOT NUMBER: 13266</p> <p>The hard drive is really running slow and is failing the Seatools quick and extended diagnostic tests. This hard drive is a "Certified Regarded H20" replacement for another Seagate hard drive that previously failed on me. I recently purchased a current version of drive and the firmware is version CV26, however Seagate does not allow me to update the firmware on this drive to a newer version to try and resolve the issue. I am unsure if all the below listed failures are related to the ST2000VX000 drive but as you can see I've had numerous failures of Seagate hard drives over the years. It seems I am not the only one that has frequent issues with this drive. Reviews on newegg.com show the same thing.</p> <p>http://www.newegg.com/Product/Product.aspx?Item=N82E16822148021 I am still buying Seagate drives because in general I've had good success with them, but the amount of failures related to the ST2000VX000 has been troubling especially since it's supposed to be a high quality drive designed for 24/7 surveillance usage.</p> <p>3/7/2013 under case number 02351436 model # ST2000VX000 and serial # X17009K3 the drive was replaced under order 5101623157.</p> <p>1/26/2013 I had a failure of a drive with serial # S24012MK.</p> <p>7/7/2012 Z2F05FAH on RMA 1005598427 in 2012.</p> <p>4/2012 drive serial # SYD1LR08 under RMA 1005162772 failed.</p> <p>I was under the impression that the warranty for the SV25 line was 3 or 5 years. If it was 3 years from date of manufacture I am just barely outside the warranty period. If it is 5 years I should still be within the warranty period. I checked the online warranty tool and called Seagate technical support but was told the drive is out of warranty.</p>	<p>I am wondering if due to the repeated failures and in the name of good customer service if you will agree to do a warranty replacement for this drive?</p> <p>If so I would hope that you could exchange it for one of the newer models that hopefully is not prone to such high failure rates such as: ST2000NM023 ST2000NM044 ST2000VX001</p> <p>Please contact me by email at king@heyndits.com to resolve this issue. Thanks for your assistance.</p>	Drive Failure	No	<p>07/15 - Pin Contact</p> <p>Still unable to reach [redacted] - left a detailed vsm msg including my direct contact number, advised on follow-up email and requested a call back / email response.</p> <p>07/13 - Em2cust</p> <p>07/17 - Em2cust</p> <p>07/17 - Confirmed with Bryan S that SR Case 04657465 Successful and shipped back to her under UPS Ground Tracking # - [redacted] contacted the Better Business Bureau because she had an issue with her Seagate product. Seagate and Mr. [redacted] have agreed to a resolution of this issue and Mr. Jackson has been provided with Seagate Management's contact information in case there are any future issues. Seagate values its customers and regrets any inconvenience this issue may have caused. Seagate considers this issue closed 07/23. Customer called Clarence back he missed her call and called her back. Clarence sent the following information here now spoken with the customer and advised her that a one time exception has been approved in order to attempt recovery on her drive at no cost to her. I advised her that there is no guarantee that we can retrieve the data but we would certainly try. I sent her the link & promo code in an email and advised her that if she has any issues submitting it to please let me know.</p> <p>07/23 Clarence reached out to the customer again and she did not answer. He sent her another email 07/22. Shereonda was not available and Clarence made another attempt to the customer 07/22. Clarence called the customer again and stated her phone did ring about 6 times before he was sent to voicemail and he did leave a message that he would attempt to call her again 07/21/15. When I followed up with the customer yesterday I was able to reach her but at approximately 15mins into the call we were disconnected. We were discussing whether or not the original data was still on the actual computer and when she didn't respond to a question I realized she was no longer connected. I tried calling her back directly but the call went straight to voicemail so I sent her an email regarding. I reached about another 15mins and tried calling again but that call also went straight to voicemail. She did respond to my email stating that her battery had died and she'd be available today at 2pm instead of the 3:30pm initially requested.</p> <p>- 07/20 Team Lead Clarence O'Brien reached out to the customer on Shereonda's absence. Clarence responded from 7/20/15 - reached out to the customer at 3:30pm but no one answered so I left a detailed message advising her who I was and that I was calling on behalf of Shereonda. I did leave my contact info but I also advised that Shereonda most likely would be attempting to call her back tomorrow. Clarence sent the customer an email as well created case#04030260. She also sent this. She responded to my email so I may actually respond back asking if there is a better time to reach her than her original request being after 3:30pm central time. Otherwise I'll just call her back after 3:30pm again.</p> <p>07/15 - Em2cust</p> <p>I believe I missed your call please call me tomorrow at 3:30 p.m. Thank you.</p> <p>07/15 - Em2cust</p>
Closed	09/29/2015 05:04 PM	05/09/2016 11:20 AM	Warranty	BBB	AMER		<p>I was sold a defective drive my info should be recovered by Seagate at no cost to me, and my drive should be replaced with a new, similar drive.</p> <p>The data on my defective drive should be recovered by Seagate at no cost to me, and my drive should be replaced with a new, similar drive. They told me a defective drive I've been complaining since 4/07/2015 with no resolution. The drive is defective they concluded it themselves but says they will charge for data recovery which is unethical you sell me a drive saying I can safely put my info on it I do what you guarantee and the drive I placed my valuable information on is no good. I want a new drive and my info restored to me at no cost. Because you told me a faulty product you are at fault not me and I am not going to pay you twice for a problem you caused me. I'm not paying you to cause me a problem.</p>	<p>New hard drive with my data on it in excellent working condition. At no charge to me because I didn't cause them a problem I paid them in full for their merchandise and it caused me a huge problem. Want this resolved at no further harm to me.</p>	Drive Failure	Yes	<p>07/15 - Em2cust</p>

Case Number	Customer Name	Customer Contact Details	Case Summary/Description	Escalation Status	Precedent Data (Case Classification)	Agent / Manager	Status / Response	Resolution/Outcome	Additional Notes / Comments
05/19/2015 07:23 PM			<p>8/19/15 Case-CRT Case 0485911 04849420</p> <p>8/16/15 Customer left a vm on Sheronda's voicemail that she was expecting 3 replacement drives. I called the customer no answer left vm. 8/19/15 I was finally able to speak to the customer on 8/16/15. Customer advised me she was working with Sheronda and then she all of a sudden didn't hear anything or receive the 3 replacement drives. Customer states Sheronda had approved free data recovery on 1 drive that she received email on 7/30/15 that data recovery was unsuccessful. I asked the customer had she spoken with anyone other than Sheronda and she advised me she was escalated to Sheronda from a lead a few months ago. This information was not under the email address given.</p> <p>After putting in the customer phone number I was able to find several different email addresses. I advised the customer it is good to keep one email address to use because she stated she never remembers what email address she uses.</p> <p>Customer then advised me again that one of her drives were at SRS, one was at another local lab and the other was with her that failed but she was able to get her data off the drives. Customer states she is just using the drives to back up her pictures but they keep failing I was able to find case 04839522.</p> <p>04847485, I advised the customer of our normal warranty policy. Customer did not know the serial numbers on the drives. I went over the 3 serial numbers that I showed registered for the customer. She states she believe they were all 3 to. I advised the customer that 2 was 3tb and 1 was 2tb. I advised the customer due to data recovery and her needed to still work on the one drive I would void the warranty on the original drives and send her 3 replacement drives on a sales order cost due to discussion with Sheronda and the delay. Customer original part numbers not in stock. I was able to find part number 1KBAA2-570 ModelSTD3000100</p> <p>NAOLMYM -voided-3tb-92QAN8-571 NA5J9RAP -voided-3tb-92QAN8-571 NA5L1C77 -voided-2tb-1CIXAN3-570 Russ 10- for voided original drives- 102093</p> <p>Sales Order(s) 520065712 created successfully Will Update warranty on all drives to 2/16 when replacement serial number available.</p> <p>Customer was good with decision and stated once this taken care of then her case will be closed. 8/17-called customer left vm and sent email 8/17. Customer left vm for Sheronda on receiving some replacement drives.</p>	Warranty	Yes		<p>05/19/2015</p> <p>Called in and left a voicemail. She states she has an ongoing issue for months and is still waiting for you to send her the replacement drives.</p> <p>Found email on file from phone number- [REDACTED]</p> <p>Email [REDACTED]</p> <p>Case- 04849420 I found an email from SRS that data recovery was unsuccessful on 7/30/15</p> <p>Thank you for contacting Seagate Recovery Services.</p> <p>I sincerely regret to provide you with the recovery results via email. I tried to contact you over the phone but I been unable</p>	Customer had data recovery that was unsuccessful	<p>05/19/2015</p> <p>SpkOust [REDACTED] states that she has received the package, but has yet to open it. Jacki says that the really appreciate all of the assistance she received... says that she wishes we could have recovered the data but does appreciate that we tried</p> <p>Explained to [REDACTED] that I will go ahead and close her case with my office, but that if she has any issue with the drives to contact me directly.</p> <p>Research- RMA 520065712 Shipping- 2-day PM UPS Tracking 1ZE27Y480258410723 NATDQ125, NATDQ19R & NATDQ19V 3TB BUP Desk) All have WED Nov 18, 2015 (3 Months) Delivered On: Monday 08/24/2015 at 12:36 P.M.</p> <p>SRS 04849420</p>
05/29/2015 04:25 PM			<p>Requesting Linda H / Customer views Linda H, as their account contact</p> <p>[REDACTED] had contacted us via email stating that his company has done many RMA's with us but normally they are setup by Linda H, whom he views as their account manager for COD's process</p>	Warranty	No	Enterprise	<p>Per our phone conversation, you would like to have a concrete agreement with Seagate on COD Replacements with Silicon Mechanics. Currently you provide your customers with this process at time of product purchase. You have provided a copy of your Top Plate Process sheet to review. On behalf of Silicon Mechanics, you are requesting Seagate create a COD policy for all Silicon Mechanics customer. You stated that the process has changed a couple of time. Please review a synopsis of our phone conversation below.</p> <p>We talked about Silicon Mechanics reestablishing the direct customer relationship with Seagate. Seagate values its customers and their service experience. Seagate's COD Policy states eligible customers (government agencies, law enforcement agencies, hospitals, doctor's offices, etc.) must provide Seagate, Macle,</p>	Policy & Procedure	
06/17/2015 10:37 AM			<p>Has 336 Hdd's that need replacing</p>	Technical	No	SSD 600 Pro's	<p>Here are the answers which the Everest-2 team could provide...</p> <p>1) How new is this drive? This unit has not been GCA's yet so it is a brand new product. What are the expectations on the firmware and having the write amplification fixed? We have no known issues with write amplification. FW will be update bi-annually and posted on webpage for downloading.</p> <p>2) What happens if these new drives have the same issues as the other Seagate 600 Pro's? (we do not have any issues with Intel or Micron) Micron hard is used.</p> <p>3) What type of warranty will Atlantic Net receive with these new drives? Typical Warranty is 5 years (at 5 drive writes per day) but this is up to sales/marketing. I can help with the Atlantic performance comparisons...</p> <p>4) Is this an inferior drive compared to the</p>	Hardware	<p>06/17/2015</p> <p>ngardn g the latest email sent directly to him at [REDACTED]</p> <p>[REDACTED] providing the contact phone #, meeting # and password.</p> <p>Per our conversation, I've scheduled a conference call with an Engineer and the Project Manager. This conference call is scheduled for June 17, 2015 at 12pm EST (11 am CST). Please call 1 (855) 856-8765 and use Meeting number: 872 332 569 & Meeting password: Solution0617 to access the conference. This is a toll free number when calling within the US. Thank you again for your continued patience. We look forward to speaking with you shortly.</p> <p>Best Regards, ?Sheronda</p> <p>Per our conversation, I've scheduled a conference call with an Engineer and the Project Manager. This</p>

06/29/2015 11:36 AM	[REDACTED]	[REDACTED] states the following... ...has tried all needed troubleshooting (different cable and power supply) ...should not have to pay \$500.00 for recovery, due to drive being defect / failure and will contact her lawyer if needed.	Warranty	Yes	Expansion	<p>07/20 Followed up with Jon B who states that the customer is all taking care of and case is closed.</p> <p>07/29 Camille Carter Customer called in while she was on hold with Paula. Paula was waiting on a response from Jon about the issue. -customer was very upset about the process, upset about things she was promised from Sheronda etc. - informed customer that I am not that department but I understood her frustrations - phone call was extremely difficult, customer was difficult and would not stop taking over me - at one point customer and I were both able to explain our frustrations about how the communication between each other. -She and I both apologized for perception and explained our reasoning why we came across that way - customer has forgiven.</p>	Technical	<p>07/13 SpaCost -Explained to customer what UPS explained to me. Michele states that her broker has told her that we can ship the drive directly from France to US and it would cost us nothing, so she called UPS and they told her the same thing. -Explained to Michele that I have already spoke with the SRIS Manager. Our shipping group here in CMC (EMEA) management in her region and they all gave advice me that the package has to be shipped intercompany, there is no way around that.</p> <p>Em2oust Michele Thallet I contacted our UPS international account rep whom stated that they would need to call me back regarding shipping freight and duties. UPS is looking into getting me a cost estimate. I will reach out to you via phone and email soon.</p>
07/01/2015 08:39 PM	[REDACTED]	<p>"How can I dump the firmware off a drive?"</p> <p>Given that it's now known that attackers can infect HD firmware (https://securelist.com/files/2015/02/Equation_group_questions_and_answers.pdf), and Seagate HDs for certain, what tools is Seagate providing its (large scale) customers to check that their drives are not infected? Is there any secret command in any of the existing firmware update tools that will let me "extract" a firmware for integrity checking, instead of just updating it?</p>	Technical	No		<p>07/17/15 I am not copied on the email to determine if the customer replied to S. Mann sent the customer the following email via gmail Dear [REDACTED] Thank you contacting Seagate. We apologize for the problem you are having with your drive. Your case was recently forwarded to our corporate office. We have tried to reach you via email due to not having a phone number on file for you but have not received a reply. Please reply to this email with your contact phone number, including preferred date & time for contact. You may also call at (800) 324-4272. If away, please leave a message. I apologize on behalf of Seagate for any inconvenience caused and look forward to speaking with you soon.</p> <p> kindest Regards,</p>	Firmware	
07/29/2015 02:27 PM	[REDACTED]	<p>Per our phone conversation, you purchased a Wireless Plus over a year ago and have not been able to use it since updating to iOS8. You were advised that we were working on a fix and it would become available. Recently you were told that there is no fix for DRM on iOS8. You requested that Seagate removing you from our marketing mailing list. You are continuing to receive promotional emails, for the same product knowing that Seagate does not have a resolution for your original complaint.</p> <p>I apologize on behalf of Seagate for any inconvenience caused. We value our customers and their service experience. We are always looking for ways to improve all aspects of the service we provide. We know the best way to do this is through customer feedback. Thank you for speaking with me. We are going to ship you two complimentary Mac compatible products (2TB portable and 4TB desktop) for customer sentiment. As discussed, I will check to ensure that your email address is removed from our marketing email distribution list. I will also be checking product availability. I have scheduled a follow-up contact with you for Monday, 08/03/15 after 12pm PST.</p> <p>Best Regards, Sheronda</p>	ANP	No	6TCK1000100	<p>8/17/15-Customer order 520064558 shipped via UPS 1ZE27Y480259433752 Delivered On: Friday, 08/14/2015 at 3:33 P.M. Left At: Residential Signed By: [REDACTED]</p> <p>Updated Warranty on drive Rous ID: 101961 Serial NATELOHSG11- Customer drive now shows delivered 8/11. Contacted the customer because I noticed that his package showed:</p> <p>DALY CITY, CA, US 08/11/2015 10:13 A.M. Customer was not available when UPS attempted delivery. We deliver to a nearby UPS Access Point™ for customer pick up UPS Access Point™ Location: THE UPS STORE 6748 MISSION ST DALY CITY, CA, US</p>	iOS 8 Update	

08/05/2015 12:00 AM		<p>Hello All,</p> <p>██████████ wants or wanted to file a complaint with the BBB against Seagate since her Seagate Wireless doesn't play DRM files since updating to iOS 8. She had left me a voice message from earlier today because she needed to know Seagate address or the correct address to use so she can file a complaint against us. She spoke with two different representatives at Western Digital that assured her that the files would play on My Passport Wireless device. One of the representatives she spoke with was by the name of Victor. I called her back and let her know that if she filed the complaint she would end up speaking with someone in the Corporate Office anyway. I let her know that I could arrange for someone from the Corporate Office contact her back. She is okay with waiting on someone to contact her regarding her complaint. I let her know that the representative from the Corporate Office is out today but that they will be back in the office tomorrow. I asked her if she specified if the device would DRM files? She basically asked them if it would play files movie files from iTunes.</p>	ANP	No	STCK1000100	<p>8/17/15- Customer still has not called back in sent the customer an email to see when she would be calling back.</p> <p>8/19/15-Customer was suppose to call me today she did not. I reached out to the customer. She did not answer. I left her a voicemail. 8/17-15-Corey-I reached out to Jen today @ 5:51 PM Central Time. She has been busy and realized that you might not be in the office today. She acknowledged that basically the ball is still in her court. She is going to attempt to reach back out to you on Monday. She was appreciative that I reached out to her today. I let her know if she needed me for anything, to please feel free to call me directly at my number. I also let her know that our representative on the corporate team is still out sick. 8/15-Hello Sheronda/ Corey,</p> <p>I reached out to this customer today. I did not receive an answer time 2</p>	iOS 8 Update	
08/10/2015 12:30 PM		<p>Thank you very much for your time on the phone. As discussed, here are the details on what was purchased for our client:</p> <p>ASI Canada - July 5, 2013 - Qty (120) - ST3000HC002 - Seagate 3TB Enterprise HDD</p> <p>ASI Canada - Sept 11, 2013 - Qty (20) - ST3000HC002 - Seagate 3TB Enterprise HDD</p> <p>The firmware is CN02</p> <p>A Serial Number: Z1F2YW7X</p> <p>If you need copies of our invoices from ASI or anything else, please let me know.</p> <p>Thank you again for your support.</p>	Warranty	No		<p>Escalation</p> <p>8/10 received escalation from Alan C. from Joanne Yo, Seagate Sales. Issue: client had another one fail on the weekend and my team will be on the phone with your warranty department to request a replacement (which can take up to 45 minutes with hold times). There is not an online form any longer for Canadian RMA's. 8/10 Attempted to contact Mr. Sales by phone. "Left voicemail w direct contact information"</p> <p>8/10 found contact number</p> <p>██████████ and was able to reach ██████████</p> <p>Seagate provided in e-mail were already in a current RMA #. Customer indicates she is the person of contact and not ██████████</p> <p>Customer indicates the following:</p> <ul style="list-style-type: none"> Read on tech sites this 3TB hdd has a 40% failure rate One of their customers 		
08/12/2015 12:00 AM		<p>Chris,</p> <p>I have an urgent member issue that was escalated to our management. Basically the member contacted Seagate customer service and hung up after sitting on hold for 45 minutes.</p> <p>Can a customer service manager contact this member asap to see what their issue might be?</p> <p>Member</p> <p>██████████</p> <p>This might be simple issue but not to even get somebody on the phone is a big concern.</p> <p>Thank you,</p> <p>██████████</p>	Technical	No	STDR1000602	<p>██████████ back to ██████████ from ██████████</p> <p>Hello ██████████</p> <p>I'm providing you a summary of our Technical Support effort to help ██████████ with his Windows XP operating system and the Seagate Dashboard software issue he experienced.</p> <p>Our agent worked with ██████████ extensively in an effort to allow his Windows XP computer to create backups to his Backup Plus drive. The underlying issue relates to the outdated operating system Windows XP, which is no longer supported by Microsoft. Due to Seagate limitations on how deep into the operating system our support team can go to resolve these types of issues, we exhausted every possible solution available to us. This includes offering an older backup software product</p>	Dashboard Software	

08/13/2015 12:00 AM		<p>Jeff Gann-I have a customer [REDACTED] who was billed for Data Recovery when I made the exception for CSO to pay for this. I have sent an email to Sheronda a few days ago regarding this matter but she has been out of the office.</p> <p>Can I get a status on when we will get her money back to her Master Card.</p> <p>Customer can be reached at [REDACTED]</p>	ANP	Yes	<p>8/17 - Jon states he credited it to the customer but can take up to 7 days. Jeff G. contacted customer for update 8/17-Emailed Jon about refund because customer advised Jeff she was going to contact her co company 8/13/15-Email Jon to refund-Jon.</p> <p>Looks like this one was approved by CRT when the form still required a CC number. I think Sheronda was supposed to do something on the back end but she has been out of office for quite some time. Can you process a refund as quickly as possible and confirm when this has been completed?</p>	Charged for Data recovery but was not suppose to be	
08/21/2015 04:09 PM		<p>[REDACTED] states that she purchased a Seagate internal from Best Buy about 5 months ago and the drive will no longer boot. ...says that she is currently at Best Buy with the drive and Best Buy who states that the drive has failed and needs to be replaced.</p>	Warranty	No	<p>Barracuda</p> <p>Triffany Burns - 8/21/2015 5:50 PM Contact: 2 Case: 04890725 RMA/S O: 110204603 Serial#: Z4Y56W5T ARF(25 Days): 60 Place of Purchase: Best Buy Environment: Standard Desktop Data Recovery Needed: N(has backup) Issue: Customer purchased HDD at Best Buy to replace internal HP five months ago. HDD has failed and she needs replacement. Exceptions: Free ERL in box Steps Taken/Resolution: -HDD pulls up as OEM anyway we try serial. Made exception since she has receipt -Explained RMA options -Offered to waive fee for ARO -Read ITA agreement -Address is verifiable everywhere BUT Melissa Potts, Lc@bestbuy.net, last [REDACTED]</p>	Warranty	
08/27/2015 10:17 PM		<p>To Whom It May Concern:</p> <p>On March 24th of this year I bought a 1 Terabyte Seagate hard drive from an authorized retailer (Best Buy in New Orleans, LA) and had it installed in my MacBook Pro. On August 5th, less than five months later, my laptop crashed, requiring me to bring it to my trusted repair store which informed me that this new hard drive had failed. The process of diagnosing the computer, necessarily requesting the Advanced Replacement service, recovering my data, and installing the new hard drive cost me a total of \$191.75. For a piece of equipment that was under warranty. Through no fault of my own I have incurred a huge cost for your faulty device and I am therefore writing to request reparations for this amount. I have attached the receipts from these expenses. I would like to receive a response resolving this issue by the end of the next business week (September 4th). I can be reached at this email address or at [REDACTED] if I do not receive a response, I will begin filing a case with California's Better Business Bureau, whom I have already contacted about this matter for informational purposes. I appreciate your time and consideration. Sincerely, [REDACTED]</p>	Warranty	No	<p>Spk2 Anna who states that she had an issue using the prepaid label at the carrier, but says that she spoke with someone and it has been fixed. Ana says that the original drive (for RMA 110201672) has been shipped.</p> <p>Received a vm msg from Anna stating that she is having trouble using the prepaid shipping label.</p> <p>Em2oust Anna, Thank you for taking the time to speak with me yesterday. We have refunded the advance shipping cost - \$29.95 plus taxes to the same method of payment used at the time of transaction. Refund confirmation: 44106178617250000132 2. Please allow 3-5 business days for processing. Seagate is unable to refund the money paid to 3rd-party company's. Seagate values its customers and their</p>		

09/02/2015 11:39 AM		<p>Hi, my name is [REDACTED] my phone number [REDACTED] I am located on the east coast. I would appreciate a call back concerning some of your products and lack of tech support services. Which is the best way and politest way I can say it as of now. If I could talk to you it would be a lot easier to explain the product problems as well as your tech problems. So that I could get this resolved prior, before, because I really don't wanna return this product to the store and I would prefer speaking to someone there first. - [REDACTED] my name is [REDACTED] And the woman at the front desk said that you promptly return calls and I believe it. Thank you and have a nice day.</p>	Technical	No	<p>US02 Steven says that he is happy with the drive, but does not like the DB folder structure and will continue to use the software he already owns.</p> <p>Chat from Zach S. he said you don't have to call him back today, quote "I'll let her not to waste a call. Everything is good to go"</p> <p>SF 05017446 Zachary Smiley - 9/2/2015 1:09 PM CIRT Call Back for Sheronda M. -Sheronda M. verified all the contact information -Explained that he ran an initial backup and it completed properly but he hasn't been able to backup anything since then -He also noted that it took 12 hours vs his other backup software which took 3 hours -Remote Session -Had the customer show me how he was trying to view the data and verify the backup. -Robert ask if we have a Corporate Office in Dublin? I stated that our Corporate Office is in Cupertino, CA and that we do have a office in Dublin; however, the Corporate Office is in Cupertino, CA - USA. ...states that has spoke with Anthony Leclerc Robert DeJong CHAT w/ Anthony Leclerc who says "He used to sell into Lacie but now we acquired them". "Explained to Robert that I would pass along his contact info to the Admins and they would pass it along to the Mark Brewer and Mark Re Robert ask if I could get one of the Mark's contact info? "Explained that I could not provide that information to him, but passing it along to the Admins would be my course of action.</p>	Backup Plus software assistance	
09/03/2015 03:18 PM		<p>[REDACTED] is requesting to speak with Mark Brewer or Mark Re regarding his business with LaCie.</p>	Pre-Sales	No	<p>Robert ask if I could get one of the Mark's contact info? "Explained that I could not provide that information to him, but passing it along to the Admins would be my course of action.</p>	Pre-Sales	
09/08/2015 10:29 AM			Technical		<p>Robert ask if I could get one of the Mark's contact info? "Explained that I could not provide that information to him, but passing it along to the Admins would be my course of action.</p> <p>Robert ask if I could get one of the Mark's contact info? "Explained that I could not provide that information to him, but passing it along to the Admins would be my course of action.</p> <p>Description: Cloning failure Escalation : call back scheduled for SAM CDT Andy West - 9/8/2015 10:26 AM Issue: I called the customer back at 9:56 AM to verify what the status is of his. Steps Taken: I spoke with the customer who stated as a bad SSD and the process was a replacement from amazon and received on Saturday. On Friday he received the recover drive from Razor and put it in and tried it and it failed and received an error code. He took it down to a computer shop and they received the same error code. Customer previously ordered another SSD drive. I'm looking for compensation customer is taking the external drive is back to Costco refund the money he is wanting compensation for the time 5 days of time spent in the process. This request.</p>		

Case Number	Customer Name	Date Closed	Fiscal Week Closed	Product Type	Recovery Results	Recovery Cost	Approved By	Quarterly Totals
SRS 04892666 SF 04873929		07/13/2015 10:02 AM	2	BUP	Unsuccessful	\$0.00	Ronald Sterling	
SRS 04894041 SF 04827505		07/16/2015 4:18 PM	2	Expansion	Successful	\$399.00	Ronald Sterling	
SRS 04921160		07/22/2015 03:22 PM	3	GoFlex Home	Successful	\$399.00	S Mann	
SRS 04924292		07/28/2015 02:21 PM	4	Barracuda	Successful	\$399.00	S Mann	
SRS 04936010 SF 04926821		07/29/2015 09:35 AM	4	BUP	Successful	\$399.00	Ronald Sterling	
SRS 04849420 SF 04839615		07/30/2015 03:58 PM	4	BUP	Unsuccessful	\$0.00	S Mann	\$1,596.00
SF 04183820 SRS 04924166		08/04/2015 11:36 AM	5	Expansion	Successful	\$399.00	Ronald Sterling	
SF 04919006 SRS 04922439		08/04/2015 07:39 AM	5	Barracuda	Successful	\$399.00	Ronald Sterling	
SF 04935264 SRS 04941662		08/05/2015 09:26 AM	5	Central	Successful	\$399.00	Ronald Sterling	
SRS 04926104		08/05/2015 12:10 PM	5	Desktop HDD	Successful	\$399.00	Sheronda Mann	
SRS 04851175		08/07/2015 02:44 PM	5	Int (OEM)	Unsuccessful	\$0.00	Andrew West	
SRS 04957833 SF 04939288		08/12/2015 10:22 AM	6	HP Int (OEM)	Successful	\$399.00	Sheronda Mann	
SRS 04947495 SF 04937575		08/13/2015 09:46 AM	6	Expansion	Successful	\$399.00	Clarence Criton	
SRS 04963954 SF 04969243		08/14/2015 04:34 PM	6	BUP for Mac	Successful	\$399.00	Markita Britton	
SRS 04969367		08/17/2015 10:42 AM	7	Int-Kit	Successful	\$399.00	Ronald Sterling	
SRS 04843300 SF 04943318		08/21/2015 09:43 AM	7	Barracuda	Successful	\$399.00	Sheronda Mann	
SRS 04948589 SF 04960905		08/24/2015 11:23 AM	8	BUP	Successful	\$399.00	Andrew West	
SRS 04968391		08/26/2015 12:01 PM	8	Central	Successful	\$399.00	Jeffrey Gann	\$4,389.00

EXHIBIT 68

Sender: Ramin Esmailzadeh <ramin.esmailzadeh@seagate.com>
Sent: Thursday, September 25, 2014 12:59:30 PM
Recipient: tom.barrett@seagate.com
Subject: Fwd: Seagate follow up UC Irvine Xyratex

Fyi,

----- Forwarded message -----

From: Frank Hanehan <frank.hanehan@seagate.com>
Date: Thu, Sep 25, 2014 at 11:55 AM
Subject: Re: Seagate follow up
To: Ramin Esmailzadeh <ramin.esmailzadeh@seagate.com>
Cc: Chris Lym <chris.lym@seagate.com>, Jan Jitze Krol <janjitze.krol@seagate.com>, William Cox <william.cox@seagate.com>

Ramin,

Below is the url for the UC Compute Research List, discussing the Seagate drive issues UC Irvine is seeing and the reference to the BackBlaze tests and website.

I believe this may also be negatively affecting a proposal we have for ClusterStor at UC Riverside as well (\$500K). The Linux Lead Sys Admin at UC Riverside worked for Harry Mangalam at UC Irvine and mentioned they are in frequent contact.

Harry Mangalam, UC Irvine, confirmed that the Moose drives they have are out of warranty and are failing on a regular basis.

<http://maillists.uci.edu/pipermail/uc-research-computing/>

If you check the threads from Jan & Feb 2014 and Jan 2013, you can see UC Davis, UC Santa Barbara and UC Office of the President (Procurement) all having visibility to this negative press on Seagate quality. BTW... not all the feedback agrees with Seagate quality issue, but I would like to find a way to make this go away at University of California.

They have 4 enclosures (SuperMicro) each with 36 - 3TB Barracuda drives installed. Harry indicated he is looking for a manufacturer to replace the Seagate drives.

Let me know what we can do.

Frank Hanehan
 925-548-9162

On Tue, Sep 23, 2014 at 7:13 PM, Ramin Esmailzadeh <ramin.esmailzadeh@seagate.com> wrote:

Thanks Frank for the update.

I'll wait til I hear from you regarding when they are available for us to analyze the drives, and also when we can present to them the Seagate Quality improvement package.

Regards,
 Ramin

Ramin Esmailzadeh | Director, Customer Technical Support | Seagate, Cupertino CA
 Ramin.Esmailzadeh@Seagate.com | Office: (408) 658-1135 | Cell: (408) 605-5750

On Tue, Sep 23, 2014 at 4:58 PM, Frank Hanehan <frank.hanehan@seagate.com> wrote:

Ramin,

I just spoke to Harry at UC Irvine. He has a meeting tomorrow, to finalize funding to replace the Seagate drives. If the funding meeting goes well, he will have drives for us soon, but if it is delayed, they may have to replace Seagate in small quantities.

When I asked him about the BackBlaze testing, I mentioned that we have people on site and are actively working the issues. He know about the "shucking" of drives, but explained that HGST, WD & Toshiba drives all went through the same process, with significantly lower failure rates.

The fact that they are requesting addl funding to replace Seagate drives is probably worse than I expected.

He said he would contact me for when we can analyze the drives.

Frank

On Tue, Sep 23, 2014 at 2:33 PM, Ramin Esmailzadeh <ramin.esmailzadeh@seagate.com> wrote:
Hi Chris,

This afternoon at 3:30pm works best for me to get on a call with the team for a strategy call.

Please let me know if this time works?

Thanks,
Ramin

Ramin Esmailzadeh | Director, Customer Technical Support | Seagate, Cupertino CA
Ramin.Esmailzadeh@Seagate.com | Office: (408) 658-1135 | Cell: (408) 605-5750

On Tue, Sep 23, 2014 at 2:26 PM, Chris Lym <chris.lym@seagate.com> wrote:
Adding Jan Jitze to this email as well, as he is our SE resource on the CSS side, out of SoCal.

Chris

On Tue, Sep 23, 2014 at 2:23 PM, Chris Lym <chris.lym@seagate.com> wrote:
Hi Ramin,

Would you have time this afternoon for a strategy conference call with Frank and Julie? (All internal.)

Say, 3PM?

Thanks,
Chris

On Tue, Sep 23, 2014 at 2:04 PM, Chris Lym <chris.lym@seagate.com> wrote:
Hi Frank,

Maybe we should take advantage of Ramin's local Southern CA sales engineering resource to get ahold of these drives sooner rather than having them be shipped somewhere. I will let Ramin engage and coordinate with you on that.

I've also added Julie to this email string so that she can help queue up an eval when you're ready to move forward. If I may also help, please let me know!

(Removing Hanish and Neil from this email chain for now so that they don't get flooded.)

Chris

On Tue, Sep 23, 2014 at 12:47 PM, Frank Hanehan <frank.hanehan@seagate.com> wrote:
Ramin, Chris,

This is the response back from UC Irvine.

They acquired Seagate Barracuda 3TB disks: Model *ST3000DM001-9YN166* and *ST3000NC002-1DY166* from Advanced HPC.

I had not yet confirmed this, but in Harry's e-mail, he did indicate that they advised all members of the UC Research Computing list not to use Seagate drives.

I asked Harry via phone if Seagate could get some of the drives for testing and he mentioned that he might be able to send us 16 or so. Do we want to arrange to test these?

I am looking to install a CP-2584 JBOD enclosure, but need to get them detail on a SAS/RAID controller for installation in a ZFS server.

Frankj

----- Forwarded message -----

From: **harry mangalam** <hjmangalam@gmail.com>
Date: Tue, Sep 23, 2014 at 12:18 PM
Subject: Re: Seagate follow up
To: Frank Hanehan <frank.hanehan@seagate.com>

On Tuesday, September 23, 2014 09:01:26 AM Frank Hanehan wrote:

- > I have been collecting information about our drive products and am working
- > to get the right people to schedule a meeting with you and UC Irvine IT
- > folks at the appropriate time. Will keep you updated on timing and topics
- > for the meeting.
- >
- > As follow up items that we discussed:
- >
- > 1. Could you send me any detail you have on failure rates and drives types
- > of Seagate drives? You had mentioned a specific system having 110 failures
- > out of 150 drives that have since been replaced with HGST drives. You
- > explained the drives were crushed, but do you have the age and model # of
- > the drives and how they were acquired (vendor).

This was the Gluster system. We bought 144 disks in 4 SuperMicro chassis, with 12 or 16 spares.

The disks were Barracuda 3TB disks: Model *ST3000DM001-9YN166*

When they started failing, we RMA'ed them and got back 're-certified' disks (which usually failed very quickly, no surprise) and kept going. When they ran out of warranty, we kept on buying more of them (eventually upgrading to the ST3000NC002-1DY166 model), certain that we must have had a bad batch and that the new ones would be much better. Fool me once...

We had already started ordering Hitachi disks when the Backblaze post came out, and after that, we alerted everyone on the UC-Research-Computing list that there was an issue and rec'ed that everyone stop using Seagates.

Of the 144 disks currently in production in the storage servers, we have

31 HGST HDN724030ALE640 <- replacements

2 ST3000DM001-1CH166 <- replacements

90 ST3000DM001-9YN166 <- original model supplied by Vendor, many replaced with the same model during warranty

21 ST3000NC002-1DY166 <- replacements

The Vendor was Advanced HPC, and they did rec going with more expensive disks, but we decided to go with the cheaper disks due to cost differential and apparent small differences in longevity based on the studies by google and UMD:

<http://static.googleusercontent.com/media/research.google.com/en/us/archive/disk_failures.pdf>

<http://www.calce.umd.edu/whats_new/2003/1203.pdf>

Our fault for that mistake.

- > 2. The drives from the Gluster file system were also Seagate drives (150)
- > and you are looking to replace these. They were in a 3U 36 drive Super
- > Micro enclosure? Do you have the drive types for this system? How old,
- > model #?

This is the same group as in 1. above.

>

- > 3. Seagate would like to install an evaluation unit onsite at UC Irvine for
- > your testing. The 5U 84 enclosure houses 84 drives with 4TB SATA or SAS
- > drives. Can we discuss the process for an evaluation system?

I'll have to get back to you on whether we could use this effectively as a JBOD. What kind of test period do you envision?

hjm

Harry Mangalam - Research Computing, OIT, Rm 225 MSTB, UC Irvine

[m/c 2225] / 92697 Google Voice Multiplexer: (949) 478-4487

415 South Circle View Dr, Irvine, CA, 92697 [shipping]

MSTB Lat/Long: (33.642025,-117.844414) (paste into Google Maps)

--
Firstname Lastname · Title on my.seagate.com
Seagate Technology, LLC
office: +CC (0)0000 000000 · mobile: +CC (0)0000 000000
www.seagate.com

--
Firstname Lastname · Title on my.seagate.com
Seagate Technology, LLC
office: +CC (0)0000 000000 · mobile: +CC (0)0000 000000
www.seagate.com

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Firstname Lastname · Title on my.seagate.com
Seagate Technology, LLC
office: +CC (0)0000 000000 · mobile: +CC (0)0000 000000
www.seagate.com

EXHIBIT 69

From: Tom Barrett <tom.barrett@seagate.com>
Subject: Re: [ACTION] Public response (Urgent) Re: Backblaze New Article
To: Ronald E Lane <ronald.e.lane@seagate.com>

Ron,
Hope you are doing well, things here are under control, just the normal bunch of issues we have. Is this the chart we had Craig do? Please forward so I have it.

Thanks,
Tom

On Tue, Apr 21, 2015 at 7:26 AM, Ronald E Lane <ronald.e.lane@seagate.com> wrote:

Clive - I am on a six week assignment in Ops in Asia. Tom Barrett is covering CTS while I am out. I will forward the general reliability chart I showed you to Tom, and then please work the response/blog with him. Tom would have been working this anyway. I do want to make sure that anything that goes into the public domain is reviewed by Legal first.

Thanks,
Ron

Sent from my iPhone

On Apr 21, 2015, at 12:30 AM, Clive J Over <clive.j.over@seagate.com> wrote:

Hi Ron,
Lets make sure to cover this during our meeting at noon.
Best
Clive

On Mon, Apr 20, 2015 at 10:23 AM, Michael Busselen
<michael.busselen@seagate.com> wrote:

Dave Mosley and I spend a few minutes on this topic last week as we prepared his remarks and responses for earnings. He is frustrated that we keep getting beaten about the head by competitors (and BackBlaze) and haven't come up with a good story on quality. He didn't have a quick answer either but I told him we are making this a priority and he agreed that if we don't tell the story no one else will.

Ron, if you can help us understand the progress we have made then we can help boil things down and communicate them. Together I'm confident we can come up with the right script.

Michael

From: Clive J Over [mailto:clive.j.over@seagate.com]

Sent: Monday, April 20, 2015 8:23 AM

To: Alan Gilda

Cc: Ronald E Sterling; John M Paulsen; Michael Busselen; Jon V Piazza; Jonathan S Long; Kirsten M Roob; Fernando Silva; Said ElBahri; Ronald E Lane

Subject: Re: [ACTION] Public response (Urgent) Re: Backblaze New Article

Thank for heads up JP and Alan

I'm getting with Ron Lane to discuss this asap.

Will come back to you with next steps.

Best

Clive

Sent from my iPhone

On Apr 20, 2015, at 8:04 AM, Alan Gilda <alan.gilda@seagate.com> wrote:

I had the following feedback from a customer on our boilerplate response to the BackBlaze article. Would we have anything to say to respond to his follow up concerns? I think this guy is looking for specific data from Seagate that refutes the BackBlaze claims.

[REDACTED]

Apr 18th, 5:16pm

Greetings. Not trying to be difficult but I'm an engineer and as the say data talks ... The article just points out The flaws in the analysis but is only speculation. Has Seagate done any analyst on the drives to confirm the speculations. There are too many drives and too public a form for Seagate

to remain mute and not refute the claims with some data of their own would seem prudent.

On Fri, Apr 17, 2015 at 11:30 AM, Alan Gilda <alan.gilda@seagate.com> wrote:

Will do. I also wanted to note that the latest BackBlaze article is also spawning more articles, such as the following:

<http://www.extremetech.com/computing/203478-backblaze-pulls-3tb-seagate-ssds-from-service-details-post-mortem-failure-rates>

On Fri, Apr 17, 2015 at 11:20 AM, Ronald E Sterling <ronald.e.sterling@seagate.com> wrote:

Team,

Below is the most recent official response that we received from the PR Team. Please use this same response to any Social Media Posts referencing the BackBlaze article.

We always value our customers' feedback and take it very seriously. It appears that Backblaze is reporting data from the same sample of drives from last year, which continues to be inconsistent with data received from other customers, and our large OEM installed base. We absolutely stand behind the quality of our products with a best-in-class warranty, and we relentlessly test our drives for the workloads they were designed to support. We highly recommend that our enterprise and data center customers use the appropriate class of product to handle the workloads of enterprise environments. Yet, as with previous data reported by Backblaze, desktop-class drives and some external drives were purchased and used in enterprise-class workloads – which they were NOT designed for nor tested to support. Therefore, we agree with Backblaze's previous comment that "It may be that those drives are less well-suited to the data center environment. Or it could be that getting them by drive farming and removing them from external USB enclosures caused problems."

We have and will continue to work closely with Backblaze directly to provide technical support and product analysis.

For more on the Backblaze hard drive report, please see this in-depth analysis from Tweaktown. <http://www.tweaktown.com/articles/6028/dispelling-backblaze-s-hdd-reliability-myth-the-real-story-covered/index.html>

Regards,

Ron Sterling

*Customer Service Supervisor
Global Seacare Solutions*

(405)324-4468

On Fri, Apr 17, 2015 at 10:50 AM, Clive J Over
<clive.j.over@seagate.com> wrote:

Hi JP,

We do not have a newer statement regarding Backblaze.
We're working with Ron Lane to gather data to do this.

Currently we recommend sticking to the current response that
you have been using.

Best

Clive

Sent from my iPhone

On Apr 16, 2015, at 11:40 AM, John M Paulsen
<john.m.paulsen@seagate.com> wrote:

Hi PR cohorts —

Is there a newer, approved public comment about
Backblaze's conclusions?

(Of course, it being social media, answering this
particular comment only makes sense today or at worst

tomorrow.)

Of course, any comment dismissing Backblaze's results as "not representative" would ideally include some proof or teeth stating Seagate's actual in-the-field failure rate is equal to all other manufacturers. :)

On Thu, Apr 16, 2015 at 11:24 AM, Said ElBahri
<said.elbahri@seagate.com> wrote:

Hi Jon,

One customer posted the new Backblaze article link on the Timeline and demanding a comment from us on the claims in the article. Backblaze concludes this time that our 3TB drives were affected by the Thailand flood, which led to low quality and high failure rates.

Please let us know if there is an official response to this new article, or should we just use the previous PR official response that was provided after the appearance of the last article from a couple of months ago. Here is the article:

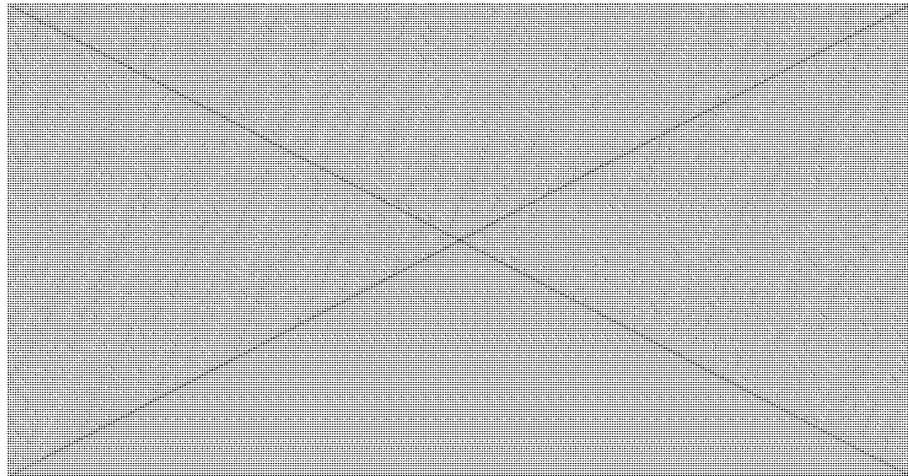
<https://www.backblaze.com/blog/3tb-hard-drive-failure/>

 **Seagate**

46 mins ·

I have always purchased seagate drives for home and work as I have always had excellent experiences with them. This morning I read an article on Seagate 3Tb drives "<https://www.backblaze.com/blog/3tb-hard-drive-failure/>" and the extreemly high failure rate.

Does Seagate have any insights into why these drives failed at such a exceptional rate as compared to other drives.



Dissecting 3TB Hard Drive Failure Rates

Beginning in January 2012, Backblaze deployed 4,829 Seagate 3TB hard drives, model ST3000DM001, into Backblaze Storage Pods. In our experience, 80% of the hard drives we deploy will function at least 4 years. As of March 31, 2015,...

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Said El Bahri
Seagate Social Media Support

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John Paulsen
Manager, B2B Social Media Content
Seagate Technology
10200 S. De Anza Blvd., Cupertino CA 95014
media.seagate.com
facebook.com/SeagateCreative
facebook.com/Seagate
twitter.com/Seagate

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Regards,

Alan Gilda
Social Media Support

[@AskSeagate](#) on Twitter

[Seagate Support](#) on Facebook

[Seagate Support](#) on Google +

<http://forums.seagate.com/> Seagate Community Forums

Online Review Support

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Regards,

Alan Gilda
Social Media Support

[@AskSeagate](#) on Twitter

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<http://forums.seagate.com/> Seagate Community Forums

Online Review Support

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m: (415) 971-1110

<http://www.seagate.com>

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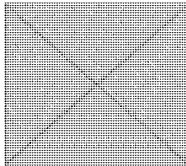
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